

CONSTRUCTION SPECIFICATIONS

DIVISION 3 - CONCRETE SECTION 03025 PRE-CAST CONCRETE BUILDING

1. GENERAL.

1.1 Scope of Work. These specifications cover the furnishing and installing of a pre-cast concrete building complete with walls, roofing, door, hardware, louvers, ventilating fan, heating unit, pipe openings and electrical equipment and insulation. The door, hardware, louvers, ventilating fan, heating equipment, and electrical equipment are described in other sections of these specifications but the pre-cast building shall be constructed to accommodate all required features. The Contractor shall coordinate construction of the building to accommodate all required features and appurtenances. The pre-cast building shall be suitable for setting on a poured in place concrete foundation and floor slab. Poured-in-place concrete shall be in accordance with the requirements of Section 03010 and Section 03020.

Structural calculations stamped by a Registered Engineer shall be submitted justifying the wall and roof design for the specified loadings.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Concrete Institute (ACI).

ACI 1211.1	Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete
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2.2 American Society of Testing and Materials (ASTM).

ASTM C-33	Concrete Aggregates
ASTM C-39 Cylindrical	Method of Test for Compressive Strength of Concrete Specimens
ASTM C-143	Method of Test for Slump of Concrete
ASTM C-150	Standard Specification for Portland Cement

ASTM C-192
Specimens
Laboratory

Method of Making and Curing Test
in the

2.3 American Welding Society (AWS)

AWS D1.1 Structural Welding Code

2.4 Precast Concrete Institute. Quality Control for Plants and
Production of Precast Prestressed Concrete Products.

3. MATERIALS.

3.1 Precast Concrete Building.

3.1.1 Design Loads. The building shall meet or exceed the
following minimum loadings. The precast building manufacturer
shall submit calculations to the Engineer demonstrating
compliance with the loading requirements.

A. Snow Load. Buildings will withstand a minimum roof snow load
of 126 pounds per square foot.

B. Wind Load. Buildings will withstand the effects of 140 mile
per hour wind load, Exposure B, with wind pressure (q_s) equal to
50.2 psf.

C. Earth Quake. Buildings will withstand the effects of a zone
2B earthquake.

D. Tolerances. Tolerances will be within the limits as dictated
by the PCI Quality Control
and Assurance Manual.

3.1.2 Precast Concrete. The concrete mix design is designed to
ACI 211.1 to produce concrete
of good workability.

Mix #7.25 R - 1 cubic yard
cement 681 lbs.
water 232 lbs. (27.8 gal.) w/c=.34
Course aggregate (SSD) 1,800 lbs.
Fine aggregate (SSD) 1,196 lbs.
Water Reducing Agent 34 oz. MB 322N
Air Entraining Agent 6 oz. MB AE-90 (4-7%)
Ave. 28 day strength 5,500 psi

Cement will be low alkali type I-II or type III conforming to
ASTM C-150. Coarse aggregates used in the concrete mix design
will conform to ASTM C33 with the designated size of coarse
aggregate #67. Minimum water/cement ratio will not exceed 0.40.

Slump will not exceed 5" with normal water reducing agent or 7" with super plasticizer. Air-entrained admixtures will conform to ASTM C260. Water reducing admixtures will conform to ASTM C494, Type A. Plasticizing admixtures will conform to ASTM C1017. Other admixtures will not be used without Engineer approval.

3.1.3 Colored Concrete. Color additives will conform to ASTM C979. A 6"x12"x2" color sample will be available for Owner approval. The following will contain colored concrete:

- a. Building roof panels.
- b. Building walls.
- c. The sample brand and type of color additive will be used throughout the manufacturing process.
- d. All ingredients will be weighed and the mixing operation will be adequate to ensure uniform dispersion of the color.

3.1.4 Cold Weather Concrete. Cold weather concrete placement will be in accordance with ACI 306. Concrete will not be placed if ambient temperature is expected to be below 35 degrees F. during the curing period unless heat is readily available to maintain the surface temperature of the concrete at least 45 degrees F. Materials containing frost or lumps of frozen materials will not be used.

3.1.5 Hot Weather Concrete. The temperature of the concrete will not exceed 80 degrees F at the time of placement and when the ambient temperature reaches 90 degrees F. The concrete will be protected with moist covering.

3.1.6 Concrete Reinforcement. All reinforcing steel will conform to ASTM A615. All welded wire fabric will conform to ASTM A185. All reinforcement will be new, free of dirt oil. Paint, grease, and loose mill scale and loose or thick rust when placed. Details not shown on drawings or specified will be to ACI 318. Steel reinforcement will be centered in the cross-sectional area of the walls and will have at least 1" of cover on the under surface of the floor and roof. The maximum allowable variation for center-center spacing of reinforcing steel will be 1/2". Full lengths of reinforcing steel will be used when possible. Reinforcing bars will be bent cold. Diagonal reinforcement will be placed around all openings.

3.1.7 Sealers and Curing Compounds. Curing compounds, if used, will be odorless, complying with ASTM C309 type I or I-D. Weatherproofing sealer for exterior of building will be clear, low gloss, water based acrylic sealer (Dayton-Superior J-24).

3.1.8 Composite Walls and Roof Insulation. The walls and roof shall be designed to provide an insulating value of at least R19.

Precast panels shall incorporate insulation into the roof section with concrete interior and exterior surfaces. Wall sections with insulation installed on interior surfaces will be allowed only when insulation is covered by fiberglass reinforced panels on all interior surfaces. Insulation shall be rigid polystyrene; fiberglass batt insulation will not be allowed.

3.1.9 Exterior Concrete Surfaces. Exterior concrete wall surfaces shall be tinted light brown with a simulated vertical natural wood grain impressed surface texture. The tinted surface shall receive a clear water repellant surface treatment. Exterior concrete roof surfaces shall be simulated cedar shake shingle roof texture, using colored concrete with a clear water repellant surface treatment. Simulated shake roofs will receive one heavy coat of pure linseed oil.

3.2 Caulking, Grout, Adhesive and Sealer. All caulking will remain flexible and non-sag at temperatures from 50 to 140 degrees Fahrenheit. Interior joints will be caulked with white "Sidewinder" by DAP. Exterior joints will be caulked with a siliconized acrylic caulk that closely matches the exterior concrete color (by GE Sealants). Roof ridge will be 100% silicon caulk (also by GE Sealants). Epoxy concrete adhesive will be two component rigid, non sag gel adhesive for bonding to dry or damp surfaces, moisture insensitive. Portland cement mortar will consist of one part Portland cement, three parts sand and enough water to make a workable mixture.

3.3 Paint. All paints and coating shall conform to the requirement of Section 09913.

3.3.1 Interior Concrete Surface. Interior concrete roof surfaces shall not be painted.

3.3.2 Metal Surfaces. Metal surfaces both inside and out shall be painted in accordance with the requirements of Section 09913.

3.4 Steel Doors. Steel doors and hardware shall conform to the requirements specified in the Section 08100 "Metal Doors and Frames" and Section 08700 "Hardware".

3.5 Wall Louvers. Wall louvers shall conform to the requirements specified in Division 15.

3.6 Cast in Place Concrete. Cast in place concrete shall conform to the requirements of Section 03010 - Portland Cement Concrete.

4. CONSTRUCTION.

The building shall be installed at the location shown on the plans and in accordance with the manufacturer's recommendations.

4.1 Cast in Place Concrete. All cast in place concrete construction shall conform to the requirements of Section 03020 - Placing and Finishing Concrete. Interior floor slab surfaces shall have a trowel finish. Exterior floor slabs shall have a light broom finish.

4.2 Cracks and Patching. Cracks in concrete building components that are judged to affect the structural integrity of the building will be cause for rejection of the building. Small holes, depressions and rock pockets will be patched with a suitable material. The patch will match the color, finish and texture of the surrounding surface. Patching will not be allowed on defective areas if the structural integrity of building is affected.

4.3 Curing and Hardening Concrete. Concrete surfaces will not be allowed to dry out from exposure to hot, dry weather during the initial curing period. Curing compounds will not be used on interior walls as they will prevent paint adhesion.

4.4 Structural Joints. Where Contractor chooses to assemble building on site, all welding will be by Certified Welders only (in accordance with AWS D1.1). Wall components will be joined together with 2 welded plate pairs at each joint. Weld plates will be anchored into the concrete panels and welded together with a continuous weld.

Walls and roof will be joined with weld plates, 2-1/2"x5", at each building corner. The joint between the floor slab and walls will be joined with a grout mixture on the inside. a matching colored caulk on the outside and two weld plates 6'' long per wall.

4.5 Painting. All steel and wood surfaces shall be painted as specified in Section 09913.

4.6 Building Quality Control and Inspection.

4.6.1 Pre-pour inspection. Check all panel measurements including diagonals (must be within 1/4 inch). Check rebar spacing and clearance. Check location of all embeds.

4.6.2 Concrete Testing. The following tests will be performed on concrete used in the manufacture of the Building. Testing will only be performed by qualified individuals who have been certified ACI Technician Grade 1. Sampling will be in accordance with ASTM C172. Test results shall be submitted to the Engineer.

- a. The slump of the concrete will be performed on the first batch of concrete in accordance with ASTM C143. This slump will be in the 3"-5" range for mixes with normal water reducing agents, and 3''-7" range for super plasticized mixes.
- b. The air content of the concrete will be checked per ASTM C231 on the first batch of concrete. The air content will be in the range of 4%-6%.
- c. The compressive strength of the cylinders will be tested to ASTM C39.
- d. Test cylinders will be taken from each other batch.
 - 1 cylinder will be tested prior to removal of forms and must be at 2,500 psi or higher.
 - 1 cylinder represents 7 day strength
 - 2 cylinders will represent 28 day strength and must be 4,500 psi or greater.

4.6.3 After Form Removal Inspection. Recheck panel dimensions. Verify that all embeds remained in place. Look for all cracks or blemishes that may cause rejection. Assure that panels are properly yarded and blocked.

4.7 Buildings Placed Upon Concrete Slabs. Install steel angle around building perimeter on a bed of caulking. Place continuous ½" x 4" neoprene rubber bearing pads around building perimeter between the steel angle and the bottom of the building wall. Walls shall be set true and plumb and securely welded together. All welding shall be done by AWS certified welders. Proof of certification shall be provided to the Engineer prior to erection. Installed doors shall be installed plumb and swing easily without dragging or binding. Attach building walls to floor slab as indicated on the drawings. Place sealant around perimeter between walls and steel angle to prevent entrance of moisture. All joints shall be properly caulked and sealed.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 3 - CONCRETE SECTION 03500 GROUT

1. GENERAL.

This section covers application of grout to fill holes, grout in sleeves, set anchor dowels and bolts, and other miscellaneous items of construction.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Society for Testing and Materials (ASTM).

ASTM C-191	Test Method for Time of Setting of Hydraulic Cement by Vicat Needle
ASTM C-827	Test Method for Early Volume Change of Cementitious Mixtures
ASTM D-696	Test Method for Coefficient of Linear Thermal Expansion of Plastics

3. MATERIALS.

3.1 Cement Based Grout. Grout for sealing holes or openings or setting pump bases shall be non-shrink grout equal to Five-Star Grout as manufactured by U.S. Grout Corporation. The grout must show no shrinkage under ASTM C-827 and must contain no expansive cements or metallic powders such as aluminum or iron filings. Grout shall consist of premeasured prepackaged materials supplied by the manufacturer requiring only the addition of water. The manufacturer's instructions must be printed on the outside of each bag. Water utilized shall be potable grade. Grout shall exhibit no shrinkage (0.00%) and have a maximum expansion of 4.0 percent when tested in accordance with ASTM C-827. The grout shall have a minimum 28-day compressive strength of 5,000 psi when tested in accordance with ASTM C-109 and shall have a minimum initial set time of 60 minutes when tested in accordance with ASTM C-191.

3.2 Epoxy Grout. Epoxy grout utilized for anchoring bolts or dowels in existing concrete shall be a pourable, non-shrink epoxy grout containing 100 percent solids. The grout shall be Five Star Epoxy Grout, or equal. The epoxy grout system shall be supplied in units consisting of three components - all premeasured and prepackaged. Resin components shall not contain any non-reactive diluents. The mixed epoxy grout shall have a minimum working life of 45 minutes at 75°F. The grout shall have 0.00 percent shrinkage and a maximum 4.0 percent expansion when tested in accordance with ASTM C-827 and have a 7-day compressive strength of 10,000 psi when tested in accordance with ASTM D-696, Method B.

3.3 Epoxy Adhesive. Epoxy adhesives for bonding fresh plastic concrete with existing concrete surfaces shall be Sikadur Hi-Mod, or equal, as manufactured by Sika. Grout components shall be prepackaged, two component, ready for field mixing.

4. CONSTRUCTION.

4.1 Cement Based Grout. Grout shall be mixed in strict accordance with manufacturers' instructions and with a minimum of water. Concrete surface to which it shall be applied shall be sandblasted and thoroughly cleaned with water. Concrete surface shall be saturated with water, but free of standing water. Grout shall be thoroughly consolidated in place and free of air voids. Grout surface shall be troweled to a smooth surface and blended with the surrounding concrete. Grout shall be struck smooth with the edges of blower base plates. Grout shall be cured with wet burlap for a minimum of five days.

Pumps and building columns shall be set on anchor bolts that have been set in the concrete bases. The pump or column base shall be leveled with nuts on the bolts beneath the base plate and set 1.5 inches above the concrete curb. The remaining open space beneath the plate shall then be grouted in place with cement based grout. Extreme care shall be utilized to make sure grout is firmly packed beneath all parts of base plates.

4.2 Epoxy Grout. Epoxy grout shall be utilized to set all expansion anchor bolts. All surfaces in contact with grout shall be thoroughly cleaned and completely dry. The grout shall be placed in strict accordance with the manufacturer's instructions. An application tube shall be utilized to pump the grout to the bottom of the annular space around bolts or dowels. The hole shall be filled from the bottom up and from one side to prevent entrapment of air bubbles. The finished surface shall be smooth.

4.3 Epoxy Adhesive. The existing surface shall be sandblasted and thoroughly cleaned prior to application of the adhesive. The adhesive shall be applied in neat form to the prepared surface.

Fresh concrete shall be applied while the adhesive is still tacky.
A 30-minute delay before pouring the fresh concrete shall be provided if recommended by the manufacturer.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 5 - METALS SECTION 05200 RIGID FRAME STEEL BUILDING

1. GENERAL.

1.1 Scope of Work. These specifications cover the material and the fabrication of the steel building so designed and constructed as to be weathertight, easily erected and with the exception of the roof and wall covering, capable of being dismantled and re-erected.

The materials furnished with the building shall include the structural framing, roofing, siding, anchor bolts, doors, windows, hardware, fasteners, sealant and any other component parts for the metal building. All materials shall be new, unused and free from defects and imperfections and fabricated in a workmanlike manner.

The building shall be the design of a manufacturer who is regularly engaged in the fabrication of pre-engineered structures conforming to the Metal Building Manufacturers Association standards.

1.2 Description. The building covered by these specifications is a multi-bay, single span, gabled, rigid-frame type structure of columns, rafters, frames and girts.

The roof purlin system shall provide continuity over the interior rigid-frame rafters. The wall girt system shall frame into and between the rigid frames and/or columns.

The roof slope shall be one (1) unit rise (vertical) to twelve (12) units run (horizontal).

1.3 Design Basis. The design of the building shall conform to the following:

Steel Construction Manual of American Institute of Steel Construction, current edition.

American Institute of Steel Construction's, "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", current edition

American Iron and Steel Institute's "Specification for the Design of Cold-Formed Steel Structural Members" of current issue.

American Welding Society "Code for Welding in Building Construction," of current issue.

ASTM Standards as amended to date:

A-325 for Quenched and Tempered Steel Bolts
A-307 for Steel Machine Bolts and Nuts

ANSI Standard B1.1 for determining tensile stress area of threaded ends of rods.

The rigid frames shall be of tapered sections considered as hinged at the base with field bolted tension-type splices at each haunch and at the ridge.

The purlins shall be designed as single span beams or as continuous beams lapping each other at each interior support. The girts shall be designed as simple beams supported at each rigid frame and/or columns.

Door and window framed openings shall be designed to replace structurally, the sidewall panels and/or framing they displace.

1.4 Design Loads. The magnitude and application of all design loads shall be as stipulated in "Design Load Criteria". After contracts are awarded, complete structural analyses shall be submitted by the metal building manufacturer to the Engineer.

1.4.1 Design Load Criteria. All loads and combinations of loads for purposes of designing structural members shall meet the requirements of the 1997 Uniform Building Code compiled by the International Conference of Building Officials in accordance with the following:

1.4.1.1 Normal Design Loads. The building manufacturer is responsible for designing the building and its components to resist the following live loads:

Ground Snow Load: 180 PSF
Roof Snow Load: 126 PSF

The structure shall sustain in addition to all dead loads and vertical hoist loads, the vertical snow load of not less than 126 psf applied on the horizontal projection of the roof structure. The live load shall be increased where applicable in accordance with "special conditions of snow load accumulations" as prescribed in the commentary of the Metal Building Manufacturers Association "Recommended Design Practices Manual" of the current issue.

Vertical Hoist Live Loads:

The structure shall sustain vertical hoist point loads induced by three hoists fully loaded to 4,000# each anywhere along their tracks at the same time to cause the most critical loading on each frame. The S10 x 25.4 and W12 x 35 beams shall be part of the dead load of the structure. The vertical loads on the pre-engineered metal building shall consider the crane loads and wind load or the crane loads and snow loads together, but not all three loads (wind, snow, crane) considered together. The building manufacturer is responsible for designing the building for the worst case vertical load combination according to paragraph 1.4.1.3.

Lateral Hoist Live Loads: The structure shall sustain lateral hoist point loads of 400# induced by each of three hoists fully loaded anywhere along their support track to cause the most critical loading on each frame. The lateral loads may be in any direction along the same plane as the hoist support rail. The lateral loads on the pre-engineered metal building shall consider the crane loads and wind loads or the crane loads and snow loads together, but not all three loads (wind, snow, crane) considered together. The building manufacturer is responsible for designing the building for the worst case lateral load combination according to paragraph 1.4.1.3.

Wind Speed: 140 MPH - Exposure B - Wind Pressure (q_s) = 50.2
psf

The structure shall withstand the forces of a the U.B.C. applicable wind pressure assumed to act in any direction and applied as a horizontal force for overall structure.

Earth Quake: Zone 2A, Seismic Importance Factor 1, Site Coefficients of $C_a=.28$ and $C_v=.40$.

The structure shall withstand the U.B.C. applicable Zone 2A lateral earthquake forces, assumed to act in any direction and applied horizontally.

1.4.1.2 Auxiliary Loads.

All other applicable superimposed dynamic and/or static loads shall be considered as part of the design requirements and combined with normal design loads as prescribed hereafter. This includes piping, hoist support and rail system, ceiling, electrical and mechanical systems. Piping loads include hanging pipe connections inside the building as well as

external pipe connections attached to the roof overhangs. Purlins shall be designed for pipe supports per contractor's locations.

1.4.1.3 Combination of Loads.

The combining of normal loads and auxiliary loads for design purposes, shall be as prescribed by the Uniform Building Code and include the following:

DL + SL	DL + 2SL + SL	DL + Aux. L
DL + WL	DL + Seismic	DL + SL + $\frac{1}{2}$ WL

1.5 Color Selection. Color of interior and exterior wall panels and the roof shall be selected by the Owner from premium available color samples provided by the Contractor.

1.6 Warranty. The building manufacturer shall provide a written warranty that the sidewalls and roof shall not rust, stain, discolor, chalk, crack, flake, blister or peel when exposed to weather at this location. The warranty shall be for the full replacement cost of the materials and installation and be prorated over a 20-year period. Manufacturer's written warranty shall be provided prior to approval of shop drawings and installation of materials.

1.7 Concrete Foundations. The concrete foundations shown on the drawings are designed based on estimated distribution of the building design loads and an assumption of base plate and bolt requirements. If the building manufacturer's loads and base plate design are not compatible with the foundation design on the drawings, the Contractor shall increase the foundation size reinforcing steel and anchor bolts as necessary to accommodate the building at no additional cost to the Owner. The Contractor shall include all foundation costs in his bid. The engineer will review the loads submitted by the building manufacturer for compatibility with foundation design and provide modified design if necessary.

2. APPLICABLE PUBLICATION.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Institute of Steel Construction (AISC).

Steel Construction Manual, current edition

2.2 American Iron and Steel Institute (AISI).

Specifications for the Design of Cold-Formed
Steel Structural Members, current issue

2.3 American Welding Society (AWS).

Code for Welding in Building Construction, current issue

2.4 American Society of Testing and Materials (ASTM).

ASTM A-36	Specification for Structural Steel
ASTM A-165	Specification for Electro-deposited Coatings of Cadmium on Steel
ASTM A-307	Specification for Carbon Steel Externally Threaded Standard Fasteners
ASTM A-325	Specification for High-Strength Bolts for Structural Steel Joints
ASTM A-386	Specification for Zinc Coating (Hot Dip) on Assembled Steel Products
ASTM A-446	Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical)
ASTM A-525	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A-529	Specification for Structural Steel with 42 ksi (290 MPA) Minimum Yield Point (1/2 in. (12.7mm) maximum thickness)
ASTM A-570	Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
ASTM A-572	Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
ASTM A-607	Specification for Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High-Strength, Low-Alloy Columbium and/or Vanadium
ASTM A-792	Specification for Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot-Dip Process, General Requirements.
ASTM B-6	Specification for Zinc (Slab Zinc)

ASTM B-633 Specification for Electro-Deposited
Coatings of Zinc on Iron and Steel

ASTM D-2092 Recommended Practices for Preparation of
Zinc-Coated Steel Surfaces for Painting

2.5 American National Standards Institute (ANSI).

ANSI B1.1 Determining Tensile Stress Area of
Threaded Ends of Rods

2.6 Federal Specifications.

QQ-S-763D Steel Bars, Wire, Shapes and Forgings,
Corrosion Resisting

TT-C-598B Caulking Compound, Oil and Resin Base Type

SS-C-00153A Cement, Bituminous, Plastic

TT-P-664C Primer Coating, Synthetic,
Rust-Inhibiting, Lacquer-Resisting

TT-S-230a Sealing Compound, Synthetic Rubber Base,
Single Component, Chemically Curing for,
Caulking, Sealing, and
Glazing in Building Construction

2.7 National Association of Architectural Metal Manufacturers (NAAMM).

NAAMM SS-1a Elastomer Base Sealant Material

NAAMM SS-1d Clear Acrylic Synthetic Polymer Sealant

3. MATERIALS.

All material shall be completely fabricated and prepared for shipment, knocked down, including any necessary crating or bundling. All parts of building are to be accurately made and true to dimension so that in erection of same, all parts will easily fit together and provide a weathertight envelope.

3.1 Bolts and Fasteners. All anchor bolts shall be of black steel having a minimum yield point of 43,300 psi, unpainted and of proper size to adequately resist all applicable design loads at base of columns and frames. They shall be positioned by the foundation contractor according to the dimensions and locations shown on the anchor bolt layout.

All high strength bolts shall be black unpainted steel and shall conform to the tentative specifications for steel machine bolts and nuts and tap bolts ASTM A-325 of current issue.

All other bolts, nuts and tap bolts shall be in accordance with tentative specification ASTM A-307 of current issue and shall be electro-galvanized conforming to ASTM A-164 of current issue. In addition, a chromate conversion treatment shall be applied over the protective zinc coating.

All sheet metal screws and/or self-tapping screws shall be of Class #410 stainless steel conforming to Federal Specification QQ-S-763D.

3.2 Structural Members. All structural members of black steel shall be either hot rolled structural shapes, cold-formed shapes or built-up shapes of welded plate construction.

Cold-formed and/or built-up welded shapes shall be fabricated from the applicable material (in accordance with the building manufacturers standards) as follows:

Hot rolled steel shapes shall be material tested in accordance with ASTM A-570 (of current issue) to meet or exceed a minimum yield point of 36,000 psi or 40,000 psi as applicable.

Thickness range of .20" through 1.125" thick shall be material tested in accordance with ASTM A-572 (of current issue) to meet or exceed a minimum yield of 50,000 psi.

Thickness range of .06" through .25" thick shall be material tested in accordance with ASTM A-607 (current issue) to meet or exceed a minimum yield point of 50,000 psi, 58,000 psi, 68,000 psi, or 70,000 psi, as applicable.

Hot rolled structural shapes shall be material conforming to ASTM A-36, A-529 or A-572 (of current issue) in accordance with the building manufacturers standards.

Galvanized steel coil used in roll formed or press broken roof and wall coverings, trim, and flashings will be material based on the requirements of ASTM A-446, and have a minimum yield strength of 50,000 psi.

Galvalume steel coil used in roll formed or press broken roof covering generally will be material based on the requirements of ASTM A-792, and have a minimum yield strength of 50,000 psi.

All brace rods of weldable quality shall be of black steel conforming to ASTM Designation A-36 (of current issue). All other brace rods shall be of black steel having a minimum yield point of 43,000 psi. Threads shall be rolled or cut. Nuts shall be semi-finished hex head.

Turnbuckles, if required, shall be standard.

All structural components of black steel except anchor bolts and fasteners shall be primed and painted as specified in Section 09913 for structural steel. All structural steel shall have an SSPC-6 surface preparation.

3.3 Roof Covering. The Standing Seam Roof Covering, carrying an Underwriters' Laboratories, Inc., Uplift Classification of not less than U.L. 90 shall consist of 16 inch to 24 inch wide panels of not less than 24 U.S. gauge aluminum coated or Galvalume coated steel with 3 inch high male and female ribs formed at the panel side laps. All panels are continuous from eave to ridge except where the panel length exceeds 40 feet or otherwise becomes prohibitive for handling purposes, in which case, endlaps are provided. Endlaps are 7'' and occur over the supporting member. The roof shall carry a 1 year weather tight warranty against leakage and a 20 year material warranty.

Roof panel to roof purlin structural attachments shall be made with clips. Clips shall be provided with movable tabs which interlock with seamed panel ribs and provide for a minimum of 1'' of panel movement in either direction from center of clip to compensate for thermal effects.

All self-drilling screws shall be of Class #410 stainless steel conforming to Federal Specification QQS-763D as applicable, cadmium coated in accordance with ASTM A-165. All weather-seal washers shall be of a hydrocarbon-based elastomer (synthetic rubber) with a stainless steel backing.

All panels shall be of G-90 galvanized coated steel tested in accordance with ASTM A-446, (of current issue) to meet or exceed a minimum yield point of 48,000 psi. The protective coating shall be a minimum 1 mil Kynar or KXL system on top and minimum 0.25 mil polyester primer on the bottom.

Metal eave and rake trim, wall cap, fascia, miscellaneous flashings, etc., shall be of steel having a minimum yield point of 37,000 psi and shall be provided with a protective coating in accordance with the building manufacturer's standard 20 year warranty system. The ridge assembly shall consist of draw formed

aluminum seam caps factory attached to standing seam ridge panels and shall provide a true expansion joint for panel movement.

3.4 Exterior Wall Covering. Exterior wall covering shall be either 13, 24 or 36 inch wide trapezoidal sculptured interlocking wall panels with nominal 2-inch deep ribs. Panels shall be 24 gage minimum thickness galvanized steel with minimum 1 mil Kynar or KXL coating. Lengths shall be continuous up to 41 feet. Side laps shall have at least one full major rib with supporting member bearing edge on the lower panel and an anti-capillary groove on the upper panel.

All interior fasteners (screws, bolts and nuts, etc.) shall be of carbon steel having a protective coating of either zinc or cadmium equal to or exceeding the minimum requirements of ASTM B-633 or A-165 respectively.

All panels shall be of coated steel tested in accordance with ASTM A-446, (of current issue) to meet or exceed a minimum yield point of 37,000 psi. The protective coating shall be as noted previously and be a minimum of one mil thick.

Metal eave and rake trim, ridge, wall cap, fascia, miscellaneous flashings, etc., shall be of steel having a minimum yield point of 37,000 psi and shall be provided with a protective coating in accordance with the building manufacturer's standard.

3.4.1 Exterior Wall Panel Trim and Flashing. Finish consists of a 1 mil Kynar based coating applied to the exterior surface of G90 galvanized steel. The color-coated panels shall be classified by Factory Mutual System as having a Class 1 fire hazard rating. The coating shall be backed by a 20 year material warranty. Color shall be as selected by Owner.

3.5 Interior Wall Liner Panel. Wall liner panel shall be minimum 26 gauge steel conforming to ASTM A-653, Grade B and providing 36 inches of coverage per panel. Panel shall have major ribs approximately 1.1 inches high. The panel shall be galvanized with an off-white Kynar or KXL finish coating. Panels shall be continuous floor to ceiling. Fastener heads shall match the wall finish.

3.6 Soffit Panels. Soffit panels shall be galvanized steel with Kynar or KXL finish coating. Soffit panels shall have 12 inches net width covering with 6 inch flat surfaces separated by V-grooves. Thickness shall be 24 gauge minimum.

3.7 Doors. See Section 08114 - Doors and Section 08710 - Hardware.

3.8 Windows. See Section 08500 - Windows.

3.9 Sealants. Sealants used in the wall and roof systems of pre-engineered metal buildings shall be standard quality of a reputable and established sealant manufacturer, approved by the manufacturer of the metal building in which the sealant is used.

All sealants shall have good cohesion as well as good adhesion to the protective coated metal and shall not be corrosive to any components on which it is applied. Each shall have adequate handling characteristics during normal ranges of construction or erection temperatures.

The sealant shall be one that will retain its weather-sealing properties under the conditions for which it is used and each sealant is recommended for only the applications listed hereafter.

For factory-applied or field-applied sealant in longitudinal ribs of standing seam roof panels, spot-sealing laps of standing seam, roof panels and sealing ridge cover, the extrudable sealant shall be of a non-migratory, non-drying and non-skinning synthetic elastomer base material conforming to the NAAMM Standard SS-1a and, except for the "tack-free time", shall conform to the performance requirements of Federal Specification TTC-598-b Type 1.

For sealing base of wall at base Zee or Channel, the extrudable sealant shall be an asphalt base bituminous plastic cement conforming to the performance requirements of interim Federal Specification SS-C-00153A Type 1.

For sealing all ridge channels, sealing exposed fillets around doors, the extrudable sealant shall be a non-drying (non-skinning) and non-migratory synthetic elastomer base material conforming to the performance requirements of Federal Specification TT-C-598-b Type 1.

For sealing narrow joints around doors, windows, or other location, the extrudable sealant shall be a clear acrylic synthetic polymer material conforming to the NAAMM Standard SS-1d for narrow joint sealants.

The extrudable sealant shall be a chemically curing type of acrylic elastomer base material conforming to the performance requirements of Federal Specification TT-S-230a Type II.

3.10 Insulation. Roof and wall insulation shall be white vinyl faced fiberglass batts with an R rating of 19 in the walls and an R rating of 30 in the ceiling. Vinyl faces shall be white with .003 inch thickness and U.L. rated for a flame spread index of 25 or less and a smoke development index of 50 or less. Roof support

shall be mesh, bars or grids installed to securely hold insulation in place. Thermal blocks shall be provided over the purlins.

3.11 Eave Gutters and Downspouts. Continuous K Style eave gutters shall form a true profile free of waviness and imperfections. They shall be formed of 24 gauge steel prefinished. The gutter shall provide positive counter flashing. It shall be sealed at downspouts and ends. The outside face shall be supported by concealed supports tied into the roof system with screws. Downspouts shall be 24 gauge galvanized and painted steel to match trim. Downspouts shall be factory crimped male/female connections and inserted 1 inch into lower section. All elbows shall be formed solid and insert into downspout.

3.12 Roof Curbs. Roof curbs shall be the one piece type fabricated with minimum 18 gauge Galvalume steel and insulated with rigid glass fiber insulation. Size shall match equipment requirements. An integral 4-inch high by full length cricket shall be provided on the upslope side. Curbs shall be mounted on secondary structural members and mounted from the top. Framing shall be compatible with roof thermal expansion and construction. Curb shall seal watertight.

4. CONSTRUCTION.

Ventilating units and louvers shall conform to the requirements of in Division 15.

All necessary drawings are to be furnished to the Engineer, including proposal drawings, clearly indicating scope of work, anchor bolt setting plan and erection information for proper assembly of the structure.

4.1 Erection. The building shall be erected on a concrete foundation as detailed in the drawings. All cutting, punching, welding and forming is to be performed at the factory. All parts shall be marked and referenced to complete erection instructions furnished with the building. Shop welding shall be by operators qualified as prescribed in the "Standard Qualifications Procedures" of the American Welding Society. The base flange shall have a fiberglass blanket placed between the flange and the concrete prior to erection.

4.2 Roofing Panels. The full length panels shall be applied with the ribs upstanding (flush face resting on or toward the purlins) and parallel to the roof slope. Securement of the roof panel to the structural framing shall be with non-exposed fasteners.

All longitudinal interlocking ribs as well as any transverse end laps shall be properly sealed according to the manufacturer's

instructions, with non-drying sealant as stipulated in "Sealants" attached to this specification.

All interlocking ribs shall contain sealant, factory applied in the female rib, and shall be field seamed together according to the manufacturer's instructions, immediately after securing in place.

All roof covering shall be properly flashed and/or sealed at the eave, ridge and rake with necessary fascias, ridge covers, etc., in accordance with the building manufacturer's standards.

4.3 Wall Panels. Wall panels shall be supplied in continuous lengths extending from the base and terminating at either the eave or rake lines providing the wall panel length does not exceed 41 feet. Horizontal wall splices may be provided at a girt (support) line to remain within this limitation. There shall be no other horizontal joints in the wall surface except over and/or under framed accessory openings and where a wall splice is needed for necessary weathertight flashing of attached structures.

All walls shall be properly flashed and/or sealed at the base, eave, rake and where siding is spliced. Sealing compounds shall conform to the Building Manufacturers' Standards as stipulated in this specification.

4.4 Appurtenances. Appurtenances shall be installed in accordance with the manufacturer's recommendations. The installation shall be complete with all clips, fasteners, sealants and etc., necessary to complete the installation. Roof penetrations shall be fitted with flow deflectors to prevent water buildup above the opening.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 5 - METALS SECTION 05500 METAL FABRICATIONS

1. GENERAL.

1.1 Basic Requirements. All metal fabrications including pipe supports shall be as specified herein and as shown on the drawings and Construction Standards. The current rules and practices set forth in the Code of Standard Practice for Steel Buildings and Bridges, and the Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, of the American Institute of Steel Construction, shall govern this work, except as otherwise noted on the plans or as otherwise specified. Welding shall be in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society.

1.2 Shop Drawings. Shop drawings shall be submitted to the Engineer for review in accordance with the requirements of the General Conditions. Material fabricated or delivered to the site before the review of shop drawings have been returned to the Contractor shall be subject to rejection.

1.3 Substitutions. Substitutions of sections, or modifications of details, or both, shall be made only when approved by the Engineer.

1.4 Responsibility for Errors. The Contractor alone shall be responsible for all errors of fabrication and for the correct fitting of the structural members shown on the shop drawings.

1.5 Templates. Templates shall be furnished as shown on the shop drawings. The Contractor shall furnish instructions for the setting of anchors and bearing plates and shall ascertain that the items are properly set during the progress of the work.

1.6 Inspection and Tests. The materials to be furnished under this specification shall be subject to inspection and tests in the shop and field by the Engineer. Inspection and tests will be conducted without expense to the Contractor, however, inspection in the shop shall not relieve the Contractor of his responsibility to furnish satisfactory materials, and the Owner reserves the right to reject any material at any time before final acceptance of the structure if the materials and workmanship do not conform to the specification requirements.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Society for Testing and Materials (ASTM).

ASTM A-36	Specification for Structural Steel
ASTM A-53	Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless
ASTM A-123	Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip
ASTM A-153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A-167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A-276	Specification for Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A-307	Specification for Carbon Steel Externally Threaded Standard Fasteners
ASTM A-386	Specification for Zinc Coating (Hot-Dip) on Assembled Steel Products
ASTM A-525	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A-563	Carbon and Alloy Steel Nuts
ASTM F-593	Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
ASTM F-594	Stainless Steel Nuts

2.2 American Institute of Steel Construction (AISI).

Manual

Steel Construction

2.3 American Welding Society (AWS).

Structural Welding Code

3. MATERIALS.

3.1 Structural Steel. Structural steel shall meet the requirements of ASTM A-36. The S 10 x 25.4 trolley beams shall be bent according to the radius dimensions shown on the plans. The bottom trolley running flange of the beam shall be smooth and contain no irregularities that would impeded a smooth running trolley hoist system.

3.2 Steel Pipe. Steel pipe shall meet the requirements of ASTM A-53, standard wall.

3.3 Stainless Steel. Stainless steel plate, sheet, and strip shall meet the requirements of ASTM Specification A-167, Type 304 and shall have a No. 1 or blast cleaned and pickled finish. Structural stainless steel shapes shall conform to ASTM A-276, Type 304, and shall be blast cleaned or pickled and free of all scale or surface contaminants.

3.4 Bolts and Nuts. Bolts and nuts shall meet the requirements of ASTM A-307 and A-563 for carbon steel and ASTM F-593 and F-594 for stainless steel. Stainless bolts shall be Alloy Group 1, Type 303, 304, or 305. All nuts and bolts shall be hex shaped.

3.5 Adhesive Anchors. Adhesive anchors shall be Type A307 Hilti (or equal) products.

3.6 Thread Lubricant. Anti-seize thread lubricants for stainless steel shall be Jet-lube "Nikal", John Crane "Thread Gard Nickel", Never-Seez "Pure Nickel Special", or Permatex "Nickel Anti-Seize Lubricant".

3.7 Galvanized Steel. Steel specified to be galvanized shall be hot dipped galvanized in conformance with ASTM A-123, A-153, A-386, or A-525 as appropriate for the steel product. All steel surfaces shall be properly cleaned and pickled prior to galvanizing.

4. CONSTRUCTION.

4.1 Design. The design of members and connections for any portions of the structure not indicated on the construction

drawings shall be completed by the fabricator. Such design shall conform to the requirements of the current issue of the Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings of the American Institute of Steel Construction. The design plans shall be submitted to the Engineer for review before any material is fabricated. Subsequent to review by the Engineer, no changes or modifications shall be made without his consent.

4.1.1 Steel Angles, Shapes and Plates. Steel angles, shapes and plates shall be fabricated to lengths and make up shown on the drawings. Hoist "S" beams rails shall be bent and connected as shown on the plans to form a complete working system.

4.2 Workmanship.

4.2.1 Connections. Connections shall be as shown on the plans. When details are not shown, the connections shall conform to the requirements for Series B, AISC standard connections. One-side or other types of eccentric connections will not be permitted unless shown in detail on the drawings.

4.2.1.1 Field Connections. Unless otherwise shown on the drawings, field connections shall be in accordance with the requirements of AISC Specifications. No combinations of rivets and bolts shall be used in the same face of any connection.

4.2.1.2 Welded Connections. Welded connections will be permitted only where shown on the drawings and shall conform to the Structural Welding Code of the American Welding Society. Welding rod for carbon steel shall be low hydrogen E-70. Welding rod for stainless steel shall match the stainless type of the members.

4.2.2 Holes. All holes shall be drilled. Holes shall not be enlarged by burning.

4.2.3 Column Bases. Column bases shall conform to the AISC Specification unless shown otherwise on the drawings.

4.2.4 Pipe Supports. Pipe supports shall be fabricated as shown on the drawings and construction standards. Carbon steel components shall be utilized in the aeration basin. Stainless steel components shall be utilized in the lift station wet well.

4.2.5 Stainless Steel Fabrications. All stainless steel fabrications shall be cleaned and free of mill and weld scale, iron, metallic salts, and other contamination. Sharp edges shall be rounded. Rough welds shall be ground smooth. All weld spatter shall be removed. The fabricator and Contractor shall utilize extreme care to avoid soiling or contaminating the finished

surfaces. The surfaces shall not be allowed to come in contact with any ferrous material or tool.

4.3 Erection.

4.3.1 Driftpins. Driftpins may be used only to bring together the several parts; they shall not be used in such a manner as to distort or damage the materials furnished.

4.3.2 Gas Cutting. The use of a gas-cutting torch in the field for correcting fabrication errors will not be permitted.

4.3.3 Field Bolts. Field bolts for stairs shall be galvanized or zinc plated. Stainless steel bolts, nut and washers and stainless steel expansion bolts shall be utilized on all steel placed underwater on all hatches and on all stainless steel supports and other stainless steel fabrications. All bolts shall be furnished with nuts and washers of the same materials.

Anti-seize thread lubricant shall be utilized on all stainless steel threaded bolts, nuts and fasteners.

4.3.4 Base Plates and Bearing Plates. Column base plates and large bearing plates shall be supported on steel wedges or shims, or leveling nuts, until the supported members have been plumbed, following which the entire bearing area shall be grouted solid with non-shrink cement-based grout.

4.4 Painting. All steel, other than stainless steel, shall be painted as specified in Section 09913, Painting.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 5 - METALS

SECTION 05903

NEW BOLTED STEEL WATER STORAGE TANK

1. GENERAL.

The Contractor shall furnish all materials, labor and equipment for fabricating, delivering, and erecting a minimum 100,000 gallon glass-coated, bolted steel, potable water storage tank with aluminum dome, complete with all necessary foundation preparations, pipeline connections and accessories specified herein. It is the intent of these specifications to provide a new tank complete and ready for use. This work shall include cleaning, hydrostatic testing, disinfecting and bacteria testing of the completed tank installation. All items of work or materials considered necessary and in accordance with good practice shall be considered a part of these specifications whether specifically mentioned herein or not.

The materials furnished and installed shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions and recommendations of the manufacturer.

1.2 Bidder Requirements. Proposals for Construction will be considered only from firms having their own fabricating plant and who have designed, fabricated and built at least three bolted steel tanks of equal or larger capacity and similar to the type specified. The Contractor shall agree to hold himself responsible for any claim made against the Owner for any infringement of patents by the use of patented articles in the construction and completion of the work, for any process connected with the work agreed to be performed under the bid and for all material used upon the said work. He shall also agree to save harmless and indemnify the purchaser from all costs, expenses and damages which the purchaser might be obliged to pay by reason of any infringement of patents in the construction and completion of the work.

1.2.1 Qualifications of Tank Manufacturer and Erector. The Engineer's selection of factory applied glass-fused-to-steel bolt together tank construction for this facility has been predicated upon specific criteria, construction methods, and an optimum coating for resistance to internal and external tank corrosion. Deviations from the specified design, construction or coating details, will not be permitted.

The Contractor shall offer a new tank structure as supplied from a manufacturer specializing in the design, fabrication and erection of factory applied glass-fused-to-steel, bolt together tanks. The

manufacturer shall employ a staff of full time design engineers, and shall own and operate its steel fabrication facilities and glass coating facilities and provide a manufacturer trained and experienced erection crew or subcontractor. The manufacturer and erector shall have at least five years of experience and have installed at least 20 bolted steel tanks of similar or larger with coating systems as specified herein.

Strict adherence to the standards of design; fabrication; erection; product quality; and long-term performance, established in this Specification will be required by the Owner and Engineer. The tank manufacturer and tank erector shall submit a list of five (5) tanks presently in potable water service designed to AWWA D-103 Standard with aluminum domes, of equal or greater size and character specified herein, operating satisfactorily for a minimum of five (5) years, including the name and telephone number of Owner and Engineer.

Only tank manufacturers and erectors who meet these qualifications and have good recommendations from all references will be considered acceptable. The Contractor is responsible for identifying an acceptable tank manufacturer and erection subcontractor prior to submitting a bid.

1.3 Tank Design Criteria.

1.3.1 Tank Size. The factory coated glass-fused-to-steel, bolt together tank shall have a nominal minimum storage capacity below the overflow of 100,000 gallons. The tank shall have an approximate diameter of 25 feet, with a nominal sidewall height (to roof eave) of 28 feet. No portion of the roof support system shall extend below the to edge of the walls.

1.3.2 Tank Capacity. Tank capacity shall be minimum 100,000 gallons (nominal, U.S. gallons) to overflow at 27.5 feet liquid depth.

1.3.3 Floor Elevation. Finished floor elevation shall be set at as shown on the plans.

1.3.4 Tank Design Standards. The materials, design, fabrication and erection of the bolt together tank shall conform to the AWWA Standard for "Factory-Coated Bolted Steel Tanks For Water Storage" - ANSI/AWWA D-103, latest revision.

The tank coating system shall conform solely to Section 10.4 of ANSI/AWWA D103 latest revision.

All materials furnished by the tank manufacturer, which are in contact with the stored water shall be certified and listed by the

National Sanitation Foundation (NSF) to meet ANSI/NSF Additives Standard No. 61. Certification of a coating type alone will not be sufficient to meet this requirement.

1.3.5 Tank Design Loads. The design loads are as follows, using 1997 Uniform Building Code and local codes:

- Water - 62.4 Lbs/C.F.
- Design Freeboard 6 inches
- Wind Velocity 140 mph, Exposure B - Wind Pressure (q_s) = 50.2 psf
- Ground and roof snow load 180 psf
- Earthquake Seismic Zone 2A,
- Importance Factor 1.0

1.5 Guarantee. The tank and coatings shall be guaranteed against defects. The Contractor shall file with the Engineer a certified guarantee from the manufacturer that the manufacturer guarantees the tank for a minimum period of one year and the glass fusion coatings on the tank interior and exterior for a minimum of 5 years (non-prorated) from the date of formal acceptance by the Owner. The manufacturer shall guarantee that he will replace at his expense the tank or parts thereof which shall prove defective within the guarantee period. The manufacturer shall also guarantee that the coatings will not fade, blister, peel, delaminate, or crack for a period of five years from the date of acceptance. If the coatings do fail in any way within the five year warranty period, the manufacturer shall replace the coatings at no additional cost to the Owner.

All guarantee work shall be done promptly by either the Contractor or the manufacturer upon submittal of proof of defect.

1.5.1 First Year Warranty Inspection. No more than one month prior to the expiration date of the Contractor's one year warranty period, the tank shall be taken out of service and inspected by the Owner's representative, the Contractor, and a representative of the tank manufacturer. The Contractor shall arrange the inspection date and provide rigging and safety equipment as necessary to permit good visual inspection of all surfaces by all parties.

If any areas of the coating on the tank interior, exterior, or appurtenances are blistered, peeling, delaminated, or exhibiting signs of corrosion, the damaged areas shall be repaired in accordance with the manufacturer's instructions at no cost to the Owner. If repairs involve more than 3 percent of the tank surface, the tank shall be replaced with a new tank with new factory applied coatings at no additional cost to the Owner.

1.5.2 Reinstating Tank Service. Following inspection and repairs, the tank shall be cleaned and hydrostatically tested in accordance with these specifications and disinfected.

1.6 Packaging. All tank sheets that pass Factory Inspection and Quality Control checks shall be protected from damage prior to packing for shipment. Heavy paper or plastic foam sheets shall be placed between each panel to eliminate sheet-to-sheet abrasion during shipment. Individual stacks of panels will be wrapped in heavy mil black plastic and steel banded to special wood pallets built to the roll-radius of the tank panels. This procedure eliminates contact or movement of finished panels during shipment.

Shipment from the factory will be by truck, hauling the tank components exclusively.

1.7 Inspection Access. The Contractor shall install hooks and scaffolding for fabrication and inspection of the tank, which conform to OSHA Standards. The hooks and scaffolding shall be left in place for use by the Engineer during inspection. Should inadequate and unsafe scaffolding be provided, the coatings will not be inspected or the tank paid for until safe provisions are made.

1.8 Drawings, Specifications and Submittals. Construction shall be governed by the drawings and specifications showing general dimensions and construction details. After written approval by the Engineer of detailed erection drawings prepared by the Manufacturer, there shall be no deviation from these drawings and specifications except upon written order or approval from the Engineer.

Five (5) copies of the shop drawings covering the tank, dome roof, foundations, anchors, accessories, connections, appurtenances and coatings provided shall be submitted for review and approval of the Engineer. A complete set of structural calculations shall be provided for the tank structure and foundation. All such submissions shall be stamped by a Licensed Professional Engineer licensed in the State of Montana, as well as, by a Licensed Professional Engineer or Structural Engineer employed on the tank manufacturer's engineering staff. Where the tank manufacturer's P.E. is licensed in the State of Montana, only one stamp is required.

The tank manufacturer's standard published warranty shall be included with submittal information. The tank manufacturer shall provide three copies of a complete Operation and Maintenance Manual for the tank upon receipt of approved drawings. Acceptable operation and maintenance manuals must be provided prior to payment. The operation and maintenance manual must meet the requirements of Section 01301.

1.9 Tank Accessories. The tank shall be furnished with a roof air vent, roof access hatch, roof access guardrail system and platform, access ladder with cage and climbing rail or intermediate platform, and access hatch in the lower wall.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Society for Testing and Materials (ASTM).

ASTM A-36	Structural Steel
ASTM A-490	Specification for Heat -Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A-570	Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM A-607	Specification for Steel, Sheet, and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold - Rolled
ASTM B-88	Standard Specification Seamless Copper Tube
ASTM D-1751	Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

2.2 American Water Works Association (AWWA).

AWWA B-300	Standard for Hypochlorites
AWWA B-301	Standard for Liquid Chlorine
AWWA C-104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C-105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C-111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C-151	Ductile-Iron Pipe, Centrifugally for Water
AWWA C-153	Ductile-Iron Compact Fittings 3-In. through 24-In and 54-In. through 64-In. for Water Service
AWWA C-200	Steel Water Pipe 6-In. and Larger
AWWA C-203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape Hot-Applied
AWWA C-206 AWWA C-210	Field Welding of Steel Water Pipe Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C-652	Disinfection of Water Storage Facilities
AWWA D-103 (latest revision)	Factory-Coated Bolted Steel Tanks for Water Storage

2.3 Aluminum Structural, Welding Code

ANSI/AWS D1.2-90

Welding shall be in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society.

1.4 Dome Design Criteria.

1.4.1 Dome Design Loads. The dome frame and skin shall be designed in accordance with the "Specifications for Aluminum Structures" as published by the Aluminum Association and designed for full dead load plus live or snow load in accordance with 1997 Uniform Building code and applicable local codes.

1. Ground and Roof Snow Load [psf] - 180 psf
2. Wind Load - 140 mph, Exp. B - Wind Pressure (q_s) = 50.2 psf
3. Seismic Zone -2A
4. Importance Factor = 1.0

1.4.2 Dome Allowable Stresses. Aluminum structural members and their connections shall be designed in accordance with the Aluminum Association's Specifications for Aluminum Structures and the following additions and clarifications.

1.4.3 Aluminum Structural Members. For members subjected to axial forces and bending moments due to load eccentricity or lateral loads, the combined member stresses shall be determined by adding the stress component due to axial load to the stress components due to bending in both the major and minor axis.

1.4.4 Snap-Through Buckling. General shell buckling shall be determined in accordance with the following formula:

$$w = \frac{2258 \times 10^6 \sqrt{I_x A}}{(SF) R^2 L}$$

Where:

w = Allowable load [pressure psf].

I_x = Moment of inertia of strut about the strong axis [in^4].

A = Cross sectional area of strut [in^2].

R = Spherical radius of dome [in].

L = Average member length [in].

SF = Safety factor (1.65).

The allowable buckling pressure shall be compared to the maximum intensities of symmetrical and nonsymmetrical load conditions.

1.4.5 Dome Design. The enclosure shall be a dome structure conforming to the specified dimensions. The dome structure shall be a fully triangulated all aluminum space truss complete with non-corrugated closure panels. It shall be clear-span and designed to be self-supporting from the periphery structure; primary horizontal thrust shall be contained by an integral tension ring. Full provisions shall be made to allow for thermal expansion. The dead weight of the dome structure shall not exceed 3.5 pounds per square foot of surface area.

The dome surface paneling shall be designed as a watertight system under all design load and temperature conditions. All raw edges of the aluminum panels shall be covered, sealed, and firmly clamped with batten bars in an interlocking manner to prevent slipping or disengagement under all load and temperature changes.

The roof framing system shall be designed as a three dimensional truss with moment-resisting joints. The design must consider the increased minor axis bending and compression induced in the framing members due to tension in the roof panels.

The structural analysis shall be performed using stiffness analysis models. The structural computer models shall include the effect of geometry irregularities such as access and vent openings and perimeter support members.

Connection forces shall be transferred through gusset plates connected to the top and bottom flanges of the beam-struts. The connections shall be designed as moment connections; a minimum of four bolts shall be used to connect the gusset plate to each strut flange.

Fasteners shall be designed with a safety factor of 2.34 on ultimate strength and 1.65 on yield strength.

The design of welded components shall be done in accordance with the Aluminum Structural Welding Code ANSI/AWS D1.2-90.

The vertical loads transferred from the roof to the tank shall be in line with the tank support wall. The transfer of horizontal loads to the tank shall be minimized by means of low friction slide supports. Radial forces applied to the tank shall not exceed 10% of the vertical reactions.

Dissimilar materials which are not compatible shall be physically separated or insulated from each other by means of gaskets or insulating compounds.

1.4.5.1 Panel Design Loads. (not acting simultaneously with the above loads) The aluminum panels shall be secured to the dome frame to withstand the following vertical loads:

- Two concentrated loads of 250 pounds each, applied simultaneously on two separate one square foot areas of the panel.
- A distributed load equal to the ground and roof snow load of 180 pounds per square foot over the total panel.

3. MATERIALS.

3.1 Plates and Sheets. Plates and sheets used in the construction of the tank shell, tank floor and tank roof, shall comply with the minimum standards of AWWA D103, latest edition. Design requirements for mild strength steel shall be ASTM A570 Grade 30 with a maximum allowable tensile stress of 14,566 psi. Design requirements for high strength steel shall be ASTM A607 Grade 50 with a maximum allowable tensile stress of 26,000 psi. The final thickness of the tank shell and tank floor shall be increased 25 percent over what is determined from the above design requirements.

The annealing effect created from the glass coated firing process shall be considered in determining ultimate steel strength. In no event shall a yield strength greater than 50,000 psi be utilized for calculations detailed in AWWA D103, Sections 3.4 and 3.5.

When multiple vertical bolt line sheets and plates of ASTM A607 Grade 50 are used, the effective net section area shall not be taken as greater than 85% of the gross area.

3.2 Glass Coating

3.2.1 Surface Preparation. Following the decoiling and shearing process, sheets shall be steel grit-blasted on both sides to the equivalent of SSPC-10. Sand blasting and chemical pickling of steel sheets is not acceptable. The surface anchor pattern shall be not less than 1.0 mil. These sheets shall be evenly oiled on both sides to protect them from corrosion during fabrication.

3.2.2 Preparation of Sheet Edges. After initial sheet preparation, all full height vertical wall sheets and all rectangular shaped floor sheets shall be machined and a thermal spray coating of a corrosion resistant alloy shall be applied to the exposed sheet edges.

3.2.3 Cleaning. After fabrication and prior to application of the coating system, all sheets shall be thoroughly cleaned by a caustic wash and hot rinse process followed immediately by hot air drying.

Inspection of the sheets shall be made for traces of foreign matter or rust. Any such sheets shall be recleaned or grit-blasted to an acceptable level of quality.

3.2.4 Coating. Coatings shall be a three coat one-fire titanium dioxide coating system equal to Vitrium by A.O. Smith Engineered Storage Products Company. All sheets shall receive one coat of a glass precoat to both sides and then air-dried. A second coat to both sides of the sheets, of milled cobalt blue glass, shall be made.

The sheets shall then be fired at a minimum temperature of 1500°F in strict accordance with the manufacturer's ISO 9001 quality process control procedures, including firing time, furnace humidity, temperature control, etc. Minimum dry coating thickness shall be 7.0 mils. The finished inside color shall be off-white. The finished outside color shall be cobalt blue.

3.2.5 Factory Inspection. The manufacture's quality system shall be ISO 9001 certified. Coated sheets shall be inspected for mil thickness (Mikrotest or equal). Coated sheets shall be checked for color uniformity by an electronic colorimeter. An electrical leak detection test shall be performed on the inside surface after fabrication of the sheet. Sheets with excessive electrical leakage shall be rejected so as to minimize field touch up.

3.3 Rolled Structural Shapes. Material shall conform to minimum standards of ASTM A36 or AISI 1010.

3.4 Horizontal Wind Stiffeners. Design requirements for intermediate horizontal wind stiffeners shall be of the "web truss" design with extended tail to create multiple layers of stiffener, permitting wind loads to distribute around tank. Web truss stiffeners shall be of steel with hot dipped galvanized coating. Rolled steel angle stiffeners are not permitted for intermediate stiffeners. No portion of the stiffener system will extend into the water below the top of the tank.

3.5 Bolt Fasteners. Bolts used in tank lap joints shall be ½" - 13 UNC- 2A rolled thread, and shall meet the minimum requirements of AWWA D103, Section 2.2.

3.5.2 Bolt Material. Bolt material shall meet the following requirements:

3.5.2.1 SAE Grade 2 (1" bolt length)

- Tensile Strength - 74,000 psi Min.
- Proof Load - 55,000 psi Min.
- Allowable shear stress - 18,163 psi (AWWA D-103).

3.5.2.2 SAE grade 8/ASTM A490 (>1" bolt length) heat-treated to:

- Tensile Strength - 150,000 psi Min.
- Proof Load - 120,000 psi Min.
- Allowable shear stress - 36,818 psi (AWWA D-103).

3.5.3 Bolt Finish - Zinc, mechanically deposited.

- 2.0 Mils Min - under bolt head, on shank and threads.

3.5.4 Bolt Head Encapsulation

- High impact polypropylene copolymer encapsulation of entire bolt head up to the splines on the shank.
- Resin shall be stabilized with an ultraviolet light resistant material such that the color shall appear black. The bolt head encapsulation shall be certified to meet the ANSI/NSF Standard 61 for indirect additives.

3.5.5 Bolts. All bolts on the vertical tank wall shall be installed such that the head portion is located inside the tank, and the washer and nut are on the exterior.

All lap joint bolts shall be properly selected such that threaded portions will not be exposed to the "shear plane" between tank sheets.

Bolt lengths shall be sized to achieve a neat and uniform appearance. Excessive threads extending beyond the nut after torquing will not be permitted.

All lap joint bolts shall include a minimum of four (4) splines on the underside of the bolt head at the shank in order to resist rotation during torquing.

3.6 Sealants. The lap joint sealant shall be a one component, moisture cured, polyurethane compound. The sealant shall be suitable for contact with potable water and shall be certified to meet ANSI/NSF Additives Standard 61 for indirect additives.

The sealant shall be used to seal lap joints and bolt connections and edge fillets for sheet notches and starter sheets. The sealant shall cure to a rubber-like consistency, have excellent adhesion to the glass coating, low shrinkage, and be suitable for interior and exterior use. Sealant shall meet the following requirements:

- Sealant curing rate at 73°F and 50% RH
- Tack-free time: 6 to 8 hours.
- Final cure time: 10 to 12 days.
- The sealant shall be a one component, moisture cured polyurethane compound.

Neoprene gaskets and tape type sealer shall not be used.

3.7 Aluminum Dome Roof . The dome and tank shall be designed to act as an integral unit. The tank shall be designed to support an aluminum dome roof including all specified live loads. The roof shall be equal to those manufactured by TEMCOR of Carson, California.

The dome shall be fabricated of the following materials:

- Triangulated dome frame struts: 6061-T6 aluminum.
- Structural frame gussets: 6061-T6 aluminum, .375" nominal thickness.
- Triangular closure panels: 0.050'' nominal thickness 3003-H16 aluminum sheet
- Perimeter tension/compression ring: 6061-T6 aluminum.
- Fasteners: 7075-T73 anodized aluminum or Series 300 stainless steel.
- Sealant: Silicone by Pecora, General Electric Silpruf or Engineer approved equal.
- Gaskets: Silicone, General Electric SE-44/88 or Engineer approved equal.
- Anchor Bolts: Series 300 stainless steel.
- Dormers, doors, and hatches: 6061-T6, 5086-H34 or 5052-H36 aluminum, .090" nominal thickness.

3.8 Roof Vent. A properly sized vent assembly in accordance with AWWA D103 shall be furnished and installed above the maximum water level of sufficient capacity so that at maximum design rate of water fill or withdrawal (7,000 gpm), the resulting interior pressure or vacuum will not exceed 0.5" water column. The overflow pipe shall not be considered to be a tank vent.

The vent shall be constructed of aluminum such that the hood can be unbolted and used as a secondary roof access.

The vent shall be so designed in construction as to prevent the entrance of birds and/or animals by including an expanded aluminum screen ($\frac{1}{2}$ inch) opening. An insect screen of 23 to 25 mesh polyester monofilament shall be provided and designed to open should the screen become plugged by ice formation.

3.9 Appurtenances (per AWWA D-103, Section 5).

3.9.1 Pipe Connections. Where pipe connections are shown to pass through tank panels, they shall be field located, saw cut, (acetylene torch cutting or welding is not permitted), and utilize an interior and exterior flange assembly and the tank shell reinforcing shall comply with AWWA D-103 latest edition. A single component urethane sealer shall be applied on any cut panel edges or bolt connections.

3.9.2 Overflow Pipe. An overflow pipe shall be Schedule 20 steel pipe conforming to AWWA C-200 extending from the overflow line to one foot above ground level and concrete splash block. Pipe shall be lined in accordance with AWWA C-206. The bottom end of the pipe shall be covered with a 24-mesh stainless steel screen. The screen shall be mounted inside the pipe. Overflow pipe shall be as detailed on the plans and shall be adequately supported inside the tank.

3.9.3 Exterior Tank Ladder. An exterior ladder shall be provided and installed as shown on the plans. Ladders shall be fabricated of aluminum or steel and utilize grooved, skid-resistant rungs. Safety cage and step-off platforms shall be fabricated of steel. Ladders shall be equipped with a hinged lockable entry device. An OSHA approved safety cage and climbing rail shall be provided on the ladder. Safety cage, handrails and support steel shall be painted. Steel bar grating for platforms shall be galvanized.

The exterior tank ladder shall be attached to the shell of the reservoir with brackets placed at intervals not to exceed 8 feet. Two OSHA approved safety belts with climbing rail devices shall be supplied to the Owner. An anti-climb closure in accordance with the details shown on the plans shall be positioned at the base of the safety cage. All components of the ladders, safety cage, platform and climbing rail shall be in complete compliance with the latest OSHA standards.

3.9.4 Access Doors. One bottom access door shall be provided in the lower tank wall as shown on the contract drawings and in accordance with AWWA D103. The manhole opening shall be a minimum of 24 inches in diameter. The access door (shell manhole) and the

tank shell reinforcing shall comply with AWWA D-103 latest edition, Sec. 5.1.

Identification Plate: A manufacturer's nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be affixed to the tank exterior sidewall at a location approximately five (5) feet from grade elevation in a position of unobstructed view.

3.10 Conveyance Pipe. The ductile iron conveyance pipe penetration shall be as detailed on the drawings using Link Seal. Pipe size shall be as indicated on the drawings. The outlet pipe shall include a 6-inch high removable silt stop at the base of the tank.

3.11 Depth Sensor Pipe. A 1-inch diameter Type K copper depth sensor pipe and fittings conforming to ASTM B-88 shall be furnished in the bottom of the tank and extended to the manhole as shown on the drawings. The depth sensor pipe penetration shall be as detailed on the drawings using Link Seal.

3.12 Concrete. Concrete and reinforcing steel shall conform to the requirements of Section 03010 and 03020. The concrete for the tank foundation shall have a minimum 28-day compressive strength of 4000 psi.

3.13 Accessory Coatings. All tank accessories and other steel items that do not have a factory applied glass fusion coating shall be painted in accordance with the requirements of Section 09913-Painting.

4. CONSTRUCTION.

Field erection of the bolted steel tank shall be in strict accordance with the tank manufacturer's requirements. Particular care shall be exercised in handling and bolting of the tank plates, supports, accessories and members to avoid abrasion or scratching of the coating.

4.1 Foundation. The tank foundation is a part of this contract and shall be installed by the Contractor. The tank foundation shall be as shown on the plans.

4.2 Tank Floor.

4.2.1 Glass Coated Bolted Steel. The standard floor design is glass-coated, bolted steel. Bolted steel panels shall be placed over a compacted sand base as shown on the plans.

A plastic encapsulated nut shall be used to cover the bolt threads exposed on the inside of the floor. The plastic encapsulation shall be Noryl GFN2-701S

Leveling of the starter ring, if used, shall be required and the maximum differential elevation within the ring shall not exceed one-eighth (1/8") inch, nor exceed one-sixteenth (1/16") inch within any ten (10) feet of length.

4.3 Sidewall Structure. Field erection of the glass-coated, bolted-steel tank shall be in strict accordance with the procedures outlined in the manufacturer's erection manual, and performed by an authorized dealer of the tank manufacturer, regularly engaged in erection of these tanks, using factory trained erectors. Specialized erection jacks and building equipment developed and manufactured by the tank manufacturer shall be used to erect the tanks. Particular care shall be taken in handling and bolting of the tank panels and members to avoid abrasion of the coating system. Prior to a liquid test, all surface areas shall be visually inspected by the Engineer. Abraded or scratched surfaces shall be repaired. If repairs are required on more than three percent of the sheet surface, the entire sheet shall be replaced.

The Contractor shall conduct an electrical leakage test or "holiday" test during erection using a wet sponge and nine (9) volt leak detection device. All electrical leak points found on the inside or outside surface shall be repaired in accordance with manufacturer's published touch up procedure. The Engineer may spot check the erector's "holiday" testing and dry film thickness and require correction if holidays or inadequate coating thickness is discovered.

The placement of sealant on each panel may be inspected prior to placement of adjacent panels. However, the Engineer's inspection shall not relieve the bidder from his responsibility for liquid tightness.

4.4 Field Coatings. All steel items not coated with the factory applied glass fusion coating shall be painted in accordance with the requirements of Section 09913-Painting.

4.5 Cathodic Protection. Cathodic protection shall not be required.

4.6 Dome Fabrication And Erection. The dome contractor shall perform the work described herein with mechanics skilled and experienced in the fabrication and erection of aluminum structures. All field work shall be directed by a qualified supervisor who will remain on the job site until completion.

Field refabrication of structural components or panels will not be accepted. Forcing of the structure to achieve fit-up during construction is expressly forbidden and not acceptable.

All sealant joints shall be tooled slightly concave after sealant is installed. Care shall be taken to keep sealant confined to joint area, and any outside of the joint shall be removed so that the panels will be free from misplaced sealant. All gasket materials shall be continuous; splices will not be allowed.

4.7 Field Testing

4.7.1 Hydrostatic. Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling tank to its overflow elevation. The tank test shall extend for 7 days (168 hours) with no measurable drop in water depth or visible signs of leakage. Any leaks disclosed by this test shall be corrected by the erector in accordance with the manufacturer's recommendations. No repair work shall be done on any joint unless the water is at least two feet below the point being repaired. If the leak test shows loss of water and no leaks are visible on the tank exterior, the Contractor shall empty the tank and conduct and inspection of the floor for proper bolt torque. If leaks through the floor continue after bolt inspection and adjustment, the Contractor shall conduct a vacuum leak test with vacuum leak testing equipment and soap solution. All leak testing shall be included in the price of the installed tank. Testing and repair shall continue until all leaks are stopped.

The Contractor shall be responsible for supplying all water required for testing at the time of tank erection completion. Disposal of test water shall be the responsibility of the Contractor. Labor and equipment necessary for tank testing is to be included in the contract price for the tank.

4.8 Cleaning. All scaffolding, planks, tools, rags and any other material not part of the structural or operating facilities of the tank shall be removed. Then the surfaces of the walls, floor, and operating facilities of the storage facility shall be cleaned thoroughly by use of a high pressure water jet, sweeping, scrubbing, or equally effective means. All water and dirt or foreign material accumulated in this cleaning operation shall be discharged from the storage facility or otherwise removed. Cleaning shall not take place until the tank sealants are fully cured.

Following the cleaning operation, the vent screen, overflow screen, and any other screened openings shall be checked and put in satisfactory condition to prevent birds, insects, and other possible contaminants from entering the facility.

4.9 Disinfection. The tank structure shall be disinfected at the time of testing by chlorination in accordance with AWWA Standard C652 "Disinfection of Water Storage Facilities". Cleaning and disinfection shall not take place until tank sealant is fully cured.

4.9.1 Forms of Chlorine for Disinfection. The forms of chlorine which may be used in the disinfecting operations are liquid chlorine, sodium hypochlorite solution, and calcium hypochlorite granules or tablets.

A. Liquid Chlorine. Liquid chlorine conforming to AWWA B-301 contains 100 percent available chlorine, and is packaged in steel containers usually of 100 lb., 150 lb., or one ton net chlorine weight. Liquid chlorine shall be used only:

- (1) In combination with appropriate gas-flow chlorinators and ejectors to provide a controlled high concentration solution feed to the water to be chlorinated.
- (2) Under the direct supervision of a person familiar with its physiological, chemical, and physical properties, and who is trained and equipped to handle any emergency that may arise, and
- (3) When appropriate safety practices are observed to protect working personnel and the public.

B. Sodium Hypochlorite. Sodium hypochlorite conforming to AWWA B-300 is available in liquid form in glass, rubber-lined, or plastic containers typically ranging in size from one quart to five gallons; containers of 30 gallons or larger size may be available in some areas. Sodium hypochlorite contains approximately from 5 percent to 15 percent available chlorine by volume, but care must be used in control of conditions and length of storage to minimize its deterioration.

C. Calcium Hypochlorite. Calcium hypochlorite conforming to AWWA B-300 is available in granular form or in small tablets, and contains approximately 65 percent available chlorine by weight. The material should be stored in a cool, dry and dark environment to minimize its deterioration.

4.9.2 Alternative Methods of Chlorination. Three methods of chlorination are given. Typically, only one method will be used for a given storage facility disinfection, but combinations of the methods may be used. The three methods are:

- (1) Chlorination of the full storage facility such that at the end of the appropriate retention period the water

will have a free chlorine residual of not less than 10 mg/L.

- (2) Spraying or painting of all storage facility water contact surfaces with a solution of 200 mg/L available chlorine.
- (3) Chlorination of full storage facility with water having a free chlorine residual of 2 mg/L after 24 hours.

4.9.3 Chlorination Method 1. The water storage facility shall be filled to the overflow level with potable water to which enough chlorine is added to provide a free chlorine residual in the full facility of not less than 10 mg/L at the end of the appropriate period of six hours or 24 hours as described herein. The chlorine, either as calcium hypochlorite, sodium hypochlorite, or liquid chlorine, shall be introduced into the water as specified.

A. Liquid Chlorine Use. Liquid chlorine shall be introduced into the water filling the storage facility to give a uniform chlorine concentration during the entire filling operation. Portable chlorination equipment shall be carefully operated and shall include a liquid chlorine cylinder, gas-flow chlorinator, chlorine ejector, safety equipment, and an appropriate solution tube to inject the high concentration chlorine solution into the filling water. The solution tube shall be inserted through an appropriate valve located on the inlet pipe and near the storage facility such that the chlorine solution will mix readily with the inflowing water.

B. Sodium Hypochlorite Use. Sodium hypochlorite shall be applied to the water entering the storage facility by means of a chemical feed pump, or shall be applied by hand-pouring into the storage facility and allowing the inflowing water to provide the desired mixing.

- (a) When a chemical feed pump is used, the concentrated chlorine solution shall be pumped through an appropriate solution tube to inject the high concentration chlorine solution at a rate which will give a uniform chlorine concentration in the filling water. The solution tube shall be inserted through an appropriate valve located on the inlet pipe and near the storage facility or through an appropriate valve located on the storage facility such that the chlorine solution will mix readily with the filling water.
- (b) When the sodium hypochlorite is poured into the storage facility, the filling of the storage facility shall begin immediately thereafter or as soon as any removed manhole

covers can be closed. The sodium hypochlorite may be poured through the cleanout or inspection manhole in the lower course or level of the storage facility, or in the riser pipe of an elevated tank, or through the roof manhole. The sodium hypochlorite shall be poured into water in the storage facility when such water is not more than three feet in depth, nor less than one foot in depth or as close thereto as manhole locations permit.

C. Calcium Hypochlorite Use. Calcium hypochlorite granules, or tablets broken or crushed to sizes not larger than ¼-inch maximum dimension, may be poured or carried into the storage facility through the cleanout or inspection manhole in the lower course or level of the storage facility, or into the riser pipe of an elevated tank, or through the roof manhole. The granules or tablet particles shall be placed in the storage facility prior to flowing water into it, and shall be so located that the inflowing water will assure a current of water circulating through the calcium hypochlorite and dissolving it during the filling operation. The calcium hypochlorite shall be placed only on dry surfaces unless adequate precautions are taken to provide ventilation or protective breathing equipment.

D. Retention Period. After the storage facility has been filled with the disinfecting water, it shall stand full as follows:

- (1) For a period of not less than six hours when the water entering the storage facility has been chlorinated uniformly by gas-feed equipment or chemical pump.
- (2) For a period of not less than 24 hours when the storage facility has been filled with water which has mixed with sodium hypochlorite or calcium hypochlorite within the storage facility as described in Paragraphs B and C.

E. Handling of Disinfection Water. After the retention period of Section 4.3.1.4, the free chlorine residual in the storage facility shall be reduced to a concentration appropriate for discharge to surface waters under the EPA discharge permit. The water shall be discharged into the nearest surface water stream using temporary piping to transport the water to the stream and prevent erosion. The water shall be released at a rate that will not erode the stream channel. The tank shall be filled to a depth of 4 feet with potable water and tested for bacteriological contamination. If there is no contamination, the tank shall again be drained and then sealed off until the plant is completed and ready to operate. Then, subject to satisfactory bacteriological testing and acceptable aesthetic quality, such water may be served to the distribution system.

A chlorine reducing agent shall be applied to the water to be drained and wasted to thoroughly neutralize the chlorine residual remaining in the water and bring it into compliance with EPA surface water discharge permit requirements.

4.9.4 Chlorination Method 2. A solution of 200 mg/L available chlorine shall be applied directly to the surfaces of all parts of the storage facility which would be in contact with water when the storage facility is full to the overflow elevation.

A. Method of Application. The chlorine solution may be applied with suitable brushes or spray equipment. The solution shall thoroughly coat all surfaces to be treated, including the inlet and outlet piping, and shall be applied to any separate drain piping such that it will have available chlorine of not less than 10 mg/L when filled with water. Overflow piping need not be disinfected.

B. Retention. The surfaces disinfected shall remain in contact with the strong chlorine solution for at least 30 minutes, after which potable water shall be admitted, the drain piping shall be purged of the 10 mg/L chlorinated water, and the storage facility shall then be filled to its overflow level. Then, subject to satisfactory bacteriological testing and acceptable aesthetic quality, such water shall be dechlorinated, drained from the tank, and discharged to the nearest stream in a manner that will not cause erosion.

4.9.5 Chlorination Method 3. Water and chlorine shall be added to the storage facility in amounts such that initially the solution will contain 50 mg/L available chlorine and will fill approximately 5 percent of the total storage volume, and this solution shall be held in the storage facility for a period of not less than six hours. The storage facility shall then be filled to the overflow level with potable water into the highly chlorinated water, and shall be held full for a period of not less than 24 hours. All highly chlorinated water shall then be dechlorinated and purged from the drain piping. Then, subject to satisfactory bacteriological testing, the remaining water shall be dechlorinated and discharged to the nearest surface stream in a manner that will not cause erosion.

A. Adding Chlorine. Chlorine shall be added to the storage facility by the method described in Sections 4.3.1, 4.3.2 or 4.3.3. The actual volume of the 50/L chlorine solution shall be such that after the solution is mixed with filling water and the storage facility is held full for 24 hours, there will be free chlorine residual of not less than 2 mg/L.

4.10 Bacteriological Sampling and Testing. After the chlorination procedure is completed, and before the storage

facility is placed in service, water from the full facility shall be sampled and tested for coliform organisms in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater. The testing shall be by either the multiple tube fermentation technique or the membrane filter technique.

A. Test for Odor. Such water also shall be tested to assure that no offensive odor exists due to chlorine reactions or excess chlorine residual.

B. Results of Testing. Two or more successive sets of samples taken at 24 hour intervals shall indicate micro-biologically satisfactory water before the facility is placed in operation.

C. Care in Sampling. The samples shall be taken from a sample tap on the outlet piping from the storage facility, or from a sample tap connected directly to the storage facility. In either case, the operation shall be such as to assure that the sample collected is actually from water that has been in the storage facility.

D. Recommended Additional Samples. During the disinfection operation and the required sampling of water from the storage facility, it is recommended that samples be taken from water inflowing to the storage facility to determine if coliforms are present in the typical potable water source.

4.11 Disposal of Disinfection and Flushing Water. Flushing and disinfection water shall be dechlorinated and discharged to the nearest surface stream in a manner that will not cause erosion. Temporary pump and piping will be installed as necessary to transport the water to the stream. The Contractor shall supply all labor, pumps, piping, equipment and miscellaneous items necessary to dispose of the water as required under this contract.

4.12 Cleanup. The Contractor shall be responsible for removing waste materials from the site and disposing of them in a legal manner before final acceptance from the Owner.

END OF SECTION

CONSTRUCTION SPECIFICATIONS
DIVISION 8 - DOORS AND WINDOWS
SECTION 08050
CAULKING AND SEALANTS

1. GENERAL.

Caulking and sealants for all doors, windows and other items called for on the plans is covered in this section.

2. APPLICABLE PUBLICATIONS.

None

3. MATERIALS.

3.1 Caulking. Caulking shall be Vulcatex caulking compound by A.C. Horn Company; Architectural Grade by DAP, Inc., or 200-R2 by Pecora Chemical Corporation.

3.2 Sealants. Sealants shall be Dow 780 or GE Silicone Sealant, Neutral color or Synthacalk GC-9, Pecora Chemical Corporation.

3.3 Primer. Primer shall be quick drying clear varnish thinned to proper consistency, of type recommended by caulking manufacturer, use as it comes from container. Apply the primer with brush. Prime the sides of joints to be caulked, except where joint is glass or metal, with one coat of colorless waterproofing.

3.4 Sealant Backer Rod or Polyethylene Foam. Sealant backer rod or polyethylene foam shall be compatible with sealant.

3.5 Oakum. Oakum shall be commercially made, non-staining type treated to prevent dry rot and mildew.

4. CONSTRUCTION AND/OR INSTALLATION.

4.1 Installation. Caulking and sealants shall be used where shown on the construction drawings and at all other locations specified. Where weather molds, staff beads, or break-back molds do not form integral parts of window or door frames, but are removable, remove same, caulk and point. Caulk between solid frame or abutting construction. Clean joints to be caulked free of mortar, other foreign materials. Set metal door sills in caulking bed.

Joints to be sealed include all joints around windows, at thresholds, door frames, all other openings in exterior walls and

at all other points where different materials join at exterior wall surfaces in order to insure a watertight job and in any other joint so indicated on the plans. Also, where seals are broken or where the caulking has fallen out, the area shall be cleaned and filled with completely new caulking.

Prime with brush that will reach all parts of joints to be filled with caulking. Hand pack oakum rope yarn. Apply caulking with hand gun.

Use gun nozzles of proper size to fit joints, drive material in with sufficient pressure to fill joints.

Prime inside surfaces of frames with primer. Butter inside edges of surfaces of frames, to be embedded within coat of caulking. Caulk jambs, heads, sills, neatly with trowel; finish joints as specified.

Neatly point finish of caulking joints on flush surface with beading tool; remove excess material. Neatly point finish of caulking joints in internal corners with coving tool; remove excess material. Caulking where exposed shall be free of wrinkles, uniformly smooth. Make caulked joints watertight. Ideal dimensions for caulking joints are 1/4" to 1/2" wide and not less than 1/2" deep. Cut or rake out joints less than 1/2" deep.

Seal all joints and spaces before final coat of paint is applied to adjacent work.

4.2 Cleaning. Remove excess compound and sealant and leave surfaces neat and cleaned of any smears or compounds or other soiling due to the caulking application. Any leakage, hardening, cracking, crumbling, melting, shrinking, running of caulking or staining of adjacent work by caulking shall be adjudged as defective work.

END OF SECTION

CONSTRUCTION SPECIFICATIONS
DIVISION 8 - DOORS AND WINDOWS
SECTION 08100
METAL DOORS AND FRAMES

1. GENERAL.

This section covers materials and installation of all doors and frames. All doors shall be furnished with all necessary hardware and any special hardware as specified under Section 08700 of these specifications.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Society of Testing and Materials (ASTM).

ASTM A-653	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process
ASTM A-924	Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM E-283	Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

3. MATERIALS.

3.1 Hollow Metal Frames. Frames shall be double rabbeted design, 16 gauge, cold rolled steel. Frames shall be mortised, reinforced, drilled and tapped to match the door template. A cover box shall be provided in back of all hardware cutouts. All frames shall be factory bonderized for maximum rust protection and paint adherence.

See the Construction Drawings for frame dimensions and sections.

3.2 Metal Doors. The type of door shall be full flush and similar to Curries 707 Series; CECO Imperial; Amweld Series 1700; or an approved equal. The steel door shall be 18 gauge, 1-3/4

inch door and fabricated in size and designs as scheduled. All doors shall have an interior core of polystyrene foam permanently bonded to the inside of each face skin. Both lock and hinge rail edges of the door shall be welded, filled and ground smooth the full height of door. Doors shall have beveled lock edged (1/8" in 2"). All doors shall have galvanized steel top caps. All doors shall be bonderized and finished as standard with one coat of baked-on prime coat paint. Steel door hardware reinforcements shall be as follows:

Hinges	14 gauge continuous channel
Locks	14 gauge continuous channel plus 16 gauge reinforcing around cutout
Closers	12 gauge
Holdes	12 gauge

Any necessary hardware templates shall be supplied by the door manufacturer.

3.3 Overhead Sectional Doors. Overhead insulated sectional doors shall be type Tricore Optima manufactured by Raynor or Engineer approved equal.

3.3.1 Door Sections. Insulated door sections shall be 3-inch thick, roll-formed, commercial quality, hot-dipped galvanized steel per ATSM A-924 and ASTM A-653. The exterior skin shall be painted as specified in Section 09913. Each door section shall be constructed of 20 gauge smooth (non-stucco) exterior skins and 25-gauge interior skins mechanically interlocked and pressure bonded to a 2-7/8" thick, non-CFC expanded polystyrene core. Interior and exterior skins shall be separated by a continuous dual durometer vinyl-extrusion held in place by a mechanical interlock to form an effective thermal break and a complete weatherseal along the section joint. End stiles shall be a minimum 16 gauge. End stiles shall be riveted to the outside face with stainless steel rivets and resistance welded to interior rail. Section panels are to be sealed at end stiles with 1/4-inch thick polyethylene foam. Weather stripping shall be provided along all sides, top and bottom of the door.

3.3.2 Track. The door track shall be hot-dipped galvanized 3-inch track per ASTM A-653. Tracks shall be bracket mounted or continuous angle mounted and fully adjustable for sealing door to jamb. Continuous angle size shall not be less than 3-1/2" x 6" x 1/8" on 3-inch track. Horizontal track shall be adequately reinforced with continuous angle.

3.3.3 Insulation. Insulation shall be 2-7/8" thick with non-CFC expanded polystyrene with an R-value of 16.0 and U-value of

0.0623, with 26-gauge, hot-dipped galvanized steel covers, painted gray.

3.3.4 Windload. Deflection of the door in a horizontal position shall be a maximum of $1/120^{\text{th}}$ of door width with a wind load of 140 mph, exposure B with wind pressure (q_s) equal to 50.2 psf.

3.3.5 Spring Counterbalance. The spring counterbalance shall be heavy-duty oil tempered wire torsion springs on a continuous ball bearing cross-header shaft. Galvanized aircraft-type lifting cables shall contain a minimum safety factor of 5 to 1.

3.3.6 Weatherstripping. The door shall be furnished with complete weatherstripping system to reduce air infiltration. The top of the door shall be provided with an EPDM rubber sealing strip. The bottom of the door shall have a flexible U-shaped vinyl seal in an extruded aluminum retainer. An optional jamb seal can be an EPDM rubber blade type attached to the track angle mounting with a rigid vinyl snap-on extrusion. Weatherstripping shall be replaceable without removal of track, angle mounting, or door hardware. Air leakage per foot of door perimeter (floor, jamb and header) shall not exceed .81 CFM @ 25 MPH. No air leakage shall be detected between section joints when tested in accordance with ASTM E-283.

3.3.7 Lock. The exterior locking shall have a five-pin tumbler cylinder with night latch and steel bar engaging track. The interior locking shall have an interior dead bolt provided with a hole to receive a padlock.

4. CONSTRUCTION AND/OR INSTALLATION.

4.1 Installation of Metal Frames.

1. For installation in steel walls the frame shall wrap around the exterior and interior steel or wood walls. Four evenly spaced steel frame anchors shall anchor the door frame to the building frame. Screws shall be used to attach the anchors to the frame.
2. Provide adjustable floor anchors.

4.2 Installation of Metal Doors.

1. All doors shall be installed in the correct location as shown on the plans.
2. All doors shall be level, square, plumb and at proper elevation.

3. Doors shall swing freely when opened and close tightly without gaps between the frame and the door.
4. All metal and masonry or finish joints shall be caulked.
5. After installation, the door shall be protected from all paint, plaster, welding, or other harmful effects.

4.3 Installation of Overhead Sectional Door. Overhead sectional door shall be installed according to the manufacturer's recommendations. Weather-stripping on all sides provide a tight seal to the door in the closed position. The track shall be installed as close to the inside wall as possible in a vertical position. If necessary the top end of the track may need to curve inward to allow the door to fit within the limited roof height. Install the door system so that there is no interference with the hoist, hoist rail, roof, lighting or any other items.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 8 - DOORS AND WINDOWS SECTION 08500 WINDOWS

1. GENERAL.

This section covers the materials and installation of all aluminum metal windows. See the construction drawings for the location and sizes of all units. Casement type windows with screens shall be provided as specified herein. Casement extrusion color shall be selected by the Owner and match building trim.

1.1 Performance Requirements. Windows shall comply with AWSI/AAMA 101 heavy commercial standards for structural adequacy with a wind load design pressure of 45 pounds per square foot (psf) and 67.5 psf test pressure, resistance to water leakage at 6.75 psf minimum and an air infiltration test pressure of 9 psf. Deflection shall not exceed 1/175 of the span at test load. Extrusion shall conform with AAWA 101. Certification of testing and compliance shall be provided.

1.2 Manufacturer's Warranty. The Contractor shall submit warranties from the window manufacturer stating that the windows furnished shall be certified as warranted against any defects in material or workmanship, under normal use and service, for a period of one year from date of fabrication.

The pigmented organic finishes on windows and component parts shall comply fully with the requirements of AAMA 603.8-92, for pigmented organic coating and fully warranted against chipping, peeling, cracking, and blistering for a period of one year from date of fabrication.

The insulated glass shall be warranted from visual obstruction, due to internal moisture, for a period of one year from date of fabrication.

1.3 Shop Drawings. The Contractor shall submit product data on the windows to the Engineer prior to ordering. The shop drawings shall include typical unit elevations and show full scale details of product's head, jamb, and sill being supplied as well as typical installation details. Anchor locations and other components not included in the manufacturer's literature shall be shown on the shop drawings.

1.4 Samples. The Contractor shall submit to the Engineer color samples on sections of aluminum stock for approval by Engineer. Tentative color shall be dark brown or bronze.

1.5 Handling and Storage. The Contractor shall store windows in a secure area prior to placement. They shall be protected against damage from the elements, construction activities and other hazards before, during and after installation.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Architectural Manufacturers Association

AAMA 101	Voluntary Specifications for Aluminum and Poly (Poly Vinyl Chloride) (PVC) Prime Windows and Glass Doors
AAMA 603.8	Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum
AAMA 605.2	Specification for High Performance Organic Coatings on Architectural Extrusions and Panels
AAMA 609-93	Voluntary Guide Specification for Cleaning and Maintenance of Painted Aluminum Extrusions and Curtain Wall Panels
AAMA CW #10	Care and Handling of Architectural Aluminum from Shop to Site
AAMA 803.3	Narrow-Joint Seam Sealer
AAMA 805.2 Components	Bonding-Type Back Bedding

2.2 American National Standards Institute.

ANSI 279.1	Tempered Safety Glass
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2.3 Federal Specifications (FS).

TT-001543	Sealants
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2.4 Flat Glass Marketing Association.

Glazing Manual

2.5 American Society of Testing and Materials (ASTM).

ASTM B 456	Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
ASTM B-633	Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM B-766 Coatings of Cadmium	Specification for Electrodeposited
ASTM C-864	Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers

3. MATERIALS.

3.1 Aluminum Window Units.

3.1.1 Aluminum Extrusions. All extruded sections shall be 0.125 and of 6063-T5 aluminum alloy and tempered as recommended by window manufacturer for strength, corrosion resistance, and application of required finish. Extruded sections shall have a minimum of 22,000 psi ultimate strength, yield of 16,000 psi.

3.1.2. Fasteners. Fasteners shall be aluminum cad-plated or stainless steel, or other material as warranted by fastener manufacturer to be non-corrosive and compatible with aluminum window members, and related components.

Do not use exposed fasteners, except where unavoidable.

Provide cad-plated or stainless steel tamperproof screws at any exposed fastener location.

Locate all fasteners so as not to bridge any thermal break.

3.1.3. Anchors clips and window accessories. Anchors clips and window accessories shall be, depending on the strength and corrosion inhibiting requirements, fabricated of aluminum, cad-plated or stainless steel or hot-dip zinc coated steel complying with ASTM B 766-86 or ASTM B 633-85.

3.1.4 Glazing. Glazing with cured rubber tape, or expanded cellular tapes shall not be permitted. All units shall be wet glazed with a

high quality silicone. All glazing beads shall be of aluminum and be finished to match the window. Rigid plastic or PVC beads shall only be acceptable if also finished to match window finish.

3.1.5. Weather-stripping. Provide weather-stripping that is extruded polyvinyl chloride or a modified neoprene bulb, applied continuously per ASTM C 864-90.

3.1.6. Sealants. Unless otherwise indicated, for sealants required within fabricated window units, provide elastomeric type as is recommended by window manufacturer for joint size and movement, and sealant shall remain permanently elastic, non shrinking and non migrating, complying with AAMA 803.3 and/or 805.2.

Finish on the window extrusions shall match the color scheme selected by the Owner.

4. CONSTRUCTION

4.1. Window Configuration. The casement out- swing function will be designated on the drawings by hinge location, and shall be of side hinge - project out design.

4.2 Accessories. Provide manufacturer's standard fabrication and accessories, which comply with specification's indicated standards and are reglazable without dismantling of vent framing, except to extent more specific or more stringent requirements are indicated. Include complete system for assembly of components and anchorage of window units and prepare complete and pre-glazed at factory.

4.2.1. Window Members. All window members, including muntin bars, shall be of aluminum. Secondary members such as friction tabs, weather-stripping, vent guides, etc. shall be of aluminum or a material compatible with aluminum. Master frame members shall no less than 2.25 inches, vents shall be of tubular design. Wall thicknesses shall be 0.125 inches and meet all ANSI/AAMA standards. The vent shall employ compression bulb seals of santoprene or polyvinyl chloride, and run in a plane around the perimeter forming a pressure contact seal, but allowing egress for water.

4.2.2. Thermal Break. The thermal barrier shall provide a continuous, uninterrupted thermal break around the entire perimeter of the frame and vents and shall not be bridged by any metal conductors at any point. It will be unacceptable for the window design to incorporate a thermal break with the de-bridged side facing the area between the frame and the operable vent. For reasons of safety and aesthetics, no sharp edges of the de-bridging process shall be exposed, therefore locate these edges to the exterior of the main frame and the interior side of the vent.

4.2.3 Hardware. Hardware having component parts which are exposed shall be of aluminum, cad-plated or stainless steel or other non-corrosive materials compatible with aluminum. Cadmium, zinc-plated or nickel- and chrome-plated steel where used must be in accordance with ASTM specification, B633 or B 456.

All primary locking devices shall be of a cast white bronze cam action lock. Two such locks shall be required when vent height exceeds 48 inches. When two such locks are required, they shall be actuated by a single lever design and a link bar application.

4.2.4. Vents. Vents shall be supported on two, four-bar, heavy-duty cad-plated or stainless steel hinge assemblies. A set screw shall be provided for precision adjustment and to vary opening and closing resistance.

4.3. Assembly. The window shall be assembled in a secure and workmanlike manner to perform as hereinafter specified. All frames shall be of butt joint construction, with vents mitered to form a watertight joint. All corners shall be epoxy welded and then mechanically fastened at corners.

4.4. Mullions and Other Structural Members. When mullions and other structural members occur, whether they are joined by integral mullions, independent mullions, or by a combination of frame members, the resulting members must be capable of withstanding the Uniform Load specified herein, and have a maximum deflection of $L/175$ of its span. When independent or integral mullions are used to join windows, evidence of compliance may be by mathematical calculations.

4.5. Glazing. The insulated glass shall be one inch in thickness, and hermetically sealed and comprised of two clear lites with thickness as size and/or loading may require. All insulating glass shall be CBA rated, and certified test reports showing the CBA rating shall be submitted.

4.6 Screens. Screen frames are to of be extruded aluminum profiles. Screen fabric shall be 18 x 16 aluminum mesh, retained in screen frames with vinyl splines that permit replacement. Screen frames shall be secured by aluminum clips fastened with cad-plated or stainless steel screws into window frames. Screen frame shall be finished to match windows.

4.7. Drainage. Provide means of drainage for rain water and/or condensation which may accumulate in members of window unit, by use of weeps in main frame and of sufficient size and quantity for this purpose, but to also prevent direct air and water infiltration.

4.8. Accessories. If indicated on drawings, panning shall be of a receiver type, extruded and finished to match, and;

Panning extrusions shall be site assembled, secured at the corners with cad-plated or stainless steel screws in integral screw boss with the joints back sealed per AAMA 803.3. Exposed fasteners are not acceptable on the exterior of pan system.

Interior trims shall be as depicted on drawings and provided in extruded profiles only. There shall be no break form shapes.

Exterior mullion covers, when they occur, shall be of extruded profiles, finished to match window system.

Receptor Systems, if indicated on drawings, shall be a two piece snap together receptor system and shall serve to anchor windows in place. The receptor shall be extruded and finished to match window with polyurethane thermal break. The receptor system shall be at head and jamb or head only, as is indicated on the drawings. An optional extruded aluminum subsill may be called for on the drawings and must also offer thermal break design.

4.9. Aluminum Finishes. Provide organic coating of type and color indicated or selected by Engineer. Color shall match selected building trim as close as possible. Comply with AAMA 603.8. Application of finish must be by window manufacturer for all components to ensure match.

4.9.1. Coating. Manufacturer's standard electrostatically applied baked enamel coating of manufacturer's standard color(s) as selected by the Engineer, and applied over manufacturer's standard substrate preparation including cleaning, degreasing, and appropriate pretreatments. Anodic finishes are also acceptable. Tentative color selection is to match building trim.

4.10 Window Installation. Comply with manufacturer's specifications and recommendations for installation of window units, and other components of work. In no case shall attachment or anchorage bridge the thermal break of the window unit, or any accessories.

Using only skilled and trained craftsmen, set units plumb and level without warp or rack of frames or sash. Anchor securely in place and separate aluminum surfaces from sources of corrosion and/or electrolytic action.

4.11 Cleanup. The Contractor shall clean all aluminum surfaces promptly after installation, per AAMA 609-93 or AAMA CW #10, as applicable and exercising care to avoid damage to finishes. Report any shipping damages to window manufacturer within 72 hours of receipt of delivery.

Installer is to make all final adjustments to vents/sash and all hardware, to insure proper seal and operation, and shall touch up any minor blemishes.

Clean all glass after installation. It shall be the Contractor's responsibility to remove any labels, excess glazing or other sealant compounds or any other dirt and foreign substances.

Initiate all protection and precautions required to ensure that window systems will be without damage or deterioration, other than normal weathering, until time of acceptance by Owner.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 8 - DOORS AND WINDOWS SECTION 08700 HARDWARE

1. GENERAL.

The Contractor shall thoroughly examine the drawings and specifications to familiarize himself with the various conditions of the hardware schedule. The hardware supplier shall check hardware with details and be responsible for fitting the same. If hardware specified will not fit properly, the Engineer shall be notified prior to bidding for modification.

Where items are not specifically mentioned, it shall match in quality and design, the balance of the hardware. All doors shall be completely fitted with hardware whether or not they are listed on a hardware schedule.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by basic designation only.

2.1 American National Standards Institute (ANSI).

3. MATERIALS.

3.1 Exterior Lockset. Exterior locksets shall have exterior access by combination lock or passage feature activated by interior thumbturn. Interior shall have passage feature. Exterior access shall also have key override. Lockset shall be Simplex/Unican Series L1000 for approved equal. Exterior shall have operating knob. Three keys each shall be provided for combination change and access. Locksets shall include all trim and strikes.

3.2 Flush Bolts (Head and Floor). Flush bolts shall be similar to Quality 1358, 12 inch; Builder Brass Works 5021, 12 inch; Trimco 3917, 12 inch, or an approved equal.

The plunger shall have one side surface milled to match guide to prevent bolt from turning and unscrewing. The plunger shall have automatic lever retraction.

3.3 Astragals. Astragals shall be similar to Pemko, Zero 140M (AL); NGP 122 N.S. (AL); or an approved equal. The astragal strip

shall be extruded anodized aluminum with a closed cell EPDM sponge neoprene strip (3/8" x 1 1/4") full height of door.

3.4 Hinges. Hinges shall be similar to Henry Soss & Co., 450TBB; Stanley FBB179; Hagar BB1279; or an approved equal.

Hinges shall be a ball bearing, full mortised. The hinges shall be 10 gauge with a four machine screw standard template pattern. All exterior outswing doors shall have a non-removable pin.

3.5 Closers. Closers shall be similar to Norton, LCN, Sargent, Glynn Johnson GJ90M or an approved equal.

The closer shall be surface mounted with adjustable backcheck and backcheck selector. The closer shall have separate regulating valves for door speed and latching speed. It shall have a versatile mounting position. The closer shall also have adjustable spring power of a full 50 percent. The arm shall be forged steel.

3.6 Door Stops. Door stops shall be similar to Quality 431 ES; Builder Brass Works F8063; Trimco 1213 ES; or an approved equal.

The door stops shall be dome type. They shall be 1" high or to match door height. The stop shall be supplied with machine screw and expansion shield.

3.7 Thresholds. Thresholds shall be similar to Pemko 171A (AL); Zero 655 (AL); National Guard Products, 425 (AL); or an approved equal.

Thresholds shall be a saddle type, 5 inches wide and 1/2" high and shall be extruded 6063-T5 Aluminum Alloy with a clear anodized finish. The surface of the threshold shall be ribbed. The threshold shall have two vertical supports running the full length of the bar.

3.8 Weather Stripping. Weather stripping shall be similar to Pemko, Zero or an approved equal.

Weather Stripping shall be 1/4" x 1/2" polyurethane, open cell (adhesive back) tape.

3.9 Door Bottoms. Door bottoms shall be similar to Pemko 412AN Zerio 351 (AL), NGP 220 S.N. (AL), or an approved equal.

The door bottoms shall have an extruded anodized aluminum case with a neoprene drop seal. The seal shall be adjustable and surface mounted.

3.10 Keys. Master key and combination all exterior doors alike. Furnish three master keys and three combination keys for each lock.

3.11 Hardware Finishes. Finish on the hardware shall be according to the following schedule:

1. Locksets - Satin chromium (26D)
2. Hinges - Satin chromium (26D) over steel
3. Closers - Aluminum finish
4. Door Stops - Aluminum finish
5. Thresholds - Aluminum finish
6. Door Bottoms - Aluminum finish

3.12 Overhead Coiling Doors Hardware. All hinges and brackets shall be made from galvanized steel. Track rollers shall have a 2-inch or 3-inch diameter wheel with hardened steel ball bearings.

3.12.1 Spring Counterbalance. The spring counterbalance shall be heavy-duty oil-tempered wire torsion springs on a continuous ball-bearing cross-header shaft. Galvanized aircraft-type lifting cables shall have a minimum safety factor of 5 to 1.

3.12.2 Weather-stripping. The bottom of the door shall have flexible U-shaped vinyl seal in an aluminum retainer. Door shall have a perimeter seal for jambs and header, as well as a seal between sections.

4. CONSTRUCTION AND/OR INSTALLATION.

4.1 Delivery of Hardware. All hardware shall be delivered to the door manufacturer or to the project in separate, clearly identified packages. Each package shall contain all trimmings, screws and necessary miscellaneous items for complete installation of the device. Each package shall be clearly labeled and numbered for its conformity with the approved hardware schedule.

4.2 Installation. The Contractor shall carefully coordinate the requirements of the door and hardware materials and manufacturing such that all necessary items and reinforcements are properly provided. All hardware shall be properly mounted in accordance with the manufacturer's instructions. Door stops shall be provided for all doors.

Thresholds shall be set in a bed of caulking. Weather-stripping tape shall be continuous between corners without splices.

Weather-stripping shall be sufficient to seal the jambs and head completely.

Keys shall be provided for the Engineer and Owner during construction. At the completion of construction, all keys and master keys shall be delivered to the Owner.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 9 - FINISHES

SECTION 09913

PAINTING

1. GENERAL.

1.1 Description. All above ground piping, supports, building trim, and wood shall be painted with one of the systems specified for that application. Factory primed metal fabrications must be surface prepared and primed with these specifications. The prime coat must be compatible with the field applied system specified herein and utilized by the Contractor. Coatings shall be applied to the exterior of all pipe.

The term "paint" as used herein includes sealers, emulsions, enamels, epoxies, and other special coatings applied for protection against corrosion or for general appearance reasons.

All field painting work shall be performed by an experienced painting contractor. The painting contractor shall be experienced in the application of epoxy and aliphatic urethane paint systems and shall submit an experience record upon request by the Engineer.

1.2 Regulatory Agency Approval. Paint utilized on pipe interiors shall be approved by EPA for use in potable water systems. Verification of EPA approval shall be submitted as part of the shop drawings if the Contractor proposes to use any paint that is not specifically named in this specification.

1.3 Safety Practices. All paint shall be applied in a safe manner and in accordance with the requirements of, the occupational Safety and Health Administration. Proper ventilation shall be provided at all times. All materials shall be stored in a safe location isolated from all sources of ignition.

1.4 Painting Work Schedule. New piping or equipment shall not be installed until painting is complete. Piping, fittings, and equipment shall be painted prior to installation whenever possible to minimize sandblasting and paint application in the work areas.

1.5 Colors. All piping shall be color coded in accordance with the color code schedule. Doors shall match the building trim. All colors shall be selected from samples at the time of construction. All colors shall be selected by the Engineer from color strips submitted with the shop drawings at the time of construction.

1.5.1 Color Code Schedule. All piping shall be painted in accordance with the following color code schedule. The Engineer

will select actual colors from sample color strips submitted by the Contractor.

Caustic:	Yellow with Green Band
Sewer:	Dark Gray
Raw Water:	Olive Green
Sludge:	Dark Brown
Backwash Water	Light Brown
Natural Gas:	Red
Sanitary Sewer and Drain Lines:	Dark Grey
Lubrication Water Lines:	Grey
Potable Water	Dark Blue
Chlorine Solution	Yellow
Polymers or Coagulant Aids	Orange with Green Band
Compressed Air	Dark Green
Sodium Sulfite	Light Green with Orange Band

The name of the liquid or gas shall be stenciled on the pipe in easily readable letters. Names shall appear at intervals not to exceed 50 feet or long continuous runs or a minimum of once on each individual shorter run. Bands shall appear every 10 feet or once on each individual shorter run. Plastic tubing for sample lines shall not be painted, but conduit enclosing tubing shall be blue.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 Occupational Safety and Health Administration (OSHA).

Manual 2206	General Industry
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2.2 Steel Structures Painting Council (SSPC).

SSPC-L	Solvent Cleaning
SSPC-3	Power Tool Cleaning
SSPC-6	Commercial Sandblast Cleaning
SSPC-10	Near White Blast Cleaning

3. MATERIALS.

3.1 General. Paint shall be well-ground, not settle badly, cake or thicken in the container, and shall be readily broken up with a paddle to a smooth consistency and shall show easy brushing properties. Non-epoxy paint shall be suitable for spraying when thinned with not more than 12 percent by volume of mineral spirits

or solvent. Epoxy or polyurethane paints shall not be thinned without the written approval of the manufacturer and Owner's Representative. All paint shall be delivered to the job in original unbroken containers with labels and tags intact. All color shall be project to the approval of the Engineer.

3.2 Piping and Related Items. Piping within the water treatment plant does not require painting as part of the Phase I contract. All piping, including all valves, operators, fittings, and pipe supports, shall be painted with one of the following paint systems.

Stainless steel pipes and aluminum supports are not to be painted.

Fabricated steel piping and supports that are hot dip galvanized shall not be painted. All paint applied to pipe interior shall be NSF or EPA approved for potable water applications. All above ground pipe shall be painted with one of the following painting systems.

<u>Engard</u>	<u>Dry Film Thickness</u>
Engard 460 Primer	4-6 mils
Engard 428 Finish Coat	2-3 mils
Minimum Total Dry Film Thickness	6 mils
<u>Tnemec</u>	
Series 20-1255 Pota-Pox Primer	4-6 mils
Series 73 Endura-Shield	1.5-3 mils
Minimum Total Dry Film Thickness	6 mils
<u>Sherwin Williams</u>	
Hi-Solids Catalyzed Epoxy	5-6 mils
Armor Seal II Polyester Aliphatic Urethane	3 mils
Minimum Dry Film Thickness	8 mils

3.3 Wood. All wood trim surfaces shall be painted with one of the following paint systems.

<u>Columbia</u>	
Primer	One coat primer Columbia 02-735-PP
	Latex Enamel Undercoater
Finished Coats	Two coats Columbia 02-042 Masterpiece Hi-Performance Interior/Exterior
Acrylic Semi-Gloss	
<u>Benjamin Moore</u>	
Primer	One prime coat Moorecraft Super-Hide
	Latex Primer-Underwater
Finish Surface	Two coats Moorecraft super-Hide Latex Semi-Gloss Enamel

Sherwin-Williams
Primer

One coat ProMar 200 or 400
Latex Wall Primer

Finished Coats

Two coats Pro Mar 200 or 400 Interior
Latex Semi-Gloss Enamels

Dry film thicknesses shall be as recommended by the manufacturer.

3.4 Structural Steel and Miscellaneous Steel Surfaces. One of the following aliphatic urethane paint systems shall be utilized on all structural steel, frames, plates, miscellaneous steel items, excluding stainless steel and hoist trolley rail surfaces. Surface preparation shall be SSPC-SP-6.

The minimum dry film thickness of the finish coating shall be as specified. Use one of the following systems or an approved equal:

Benjamin Moore

Dry Film Thickness

M33 Polyamide Epoxy Primer	2-4 mils
M74 Aliphatic Acrylic Urethane Gloss	2-3 mils
Minimum Total Dry Film Thickness	6 mils

Tnemec

Series 66 - 1212 polyamide Epoxy	3-5 mils
Series 73 Endura-Shield	2.0 - 3 mils
Minimum Total Dry Thickness	6 mils

Sherwin Williams

Minimum Dry Film Thickness	6 mils
Acrolon Multi-Mil	

Dry film thicknesses specified are absolute minimums. Average thicknesses shall exceed these values. Additional top coats shall be applied as necessary to meet these requirements.

If shop primed steel is to be utilized, the Contractor shall utilize a three coat system with an epoxy organic zinc rich shop primer, an intermediate epoxy tie coat as recommended by the finish paint manufacturer and one of the finish coats as specified above. The primer shall contain at least 83 percent zinc by weight in the dry film with a minimum dry film thickness of 2.5 mils and be recommended and manufactured by the same company as the finish coat. Minimum dry film thickness for all three coats is 8.5 mils. All shop primed steel shall meet these primer requirements.

The S10 x 25.4 hoist trolley rail final surface shall be free of irregularities that would impede a smooth running hoist trolley system.

3.5 Water Tank Accessories, Pumps, Piping, and Related Items. All new pumps (excluding submersible pumps) and piping, including all valves, operators, fittings, pipe supports, water tank accessories such as ladders, cages and handrail shall be painted with one of the following paint systems. Stainless steel pipes and supports are not to be painted. Fabricated steel piping and supports that are hot dip galvanized shall not be painted. All paint applied to pipe interior shall be NSF or EPA approved for potable water applications.

4. CONSTRUCTION.

4.1 Surface Preparation. All surfaces shall be adequately prepared to receive the primer and/or top coating. Surface preparation shall be as specified. Items not specified shall be prepared in accordance with manufacturer's recommendation.

Dirt and foreign matter shall be removed by bristle brushes, blow cleaning with air pressure, or steam cleaning. Deposits of oil or grease shall not be spread over additional area in the cleaning process and shall be removed prior to sandblasting where blasting is required.

Oil or grease shall be removed with solvents or commercial detergents. Change rags and solvent frequently. Be sure area is well ventilated.

Mold or mildew shall be removed before painting by scrubbing with a mixture of one quart household bleach in three quarts of water.

4.1.1 Wood. Wood shall be clean and dry. Knots and pitch streaks shall be scraped or burned, sanded and spot primed before full priming coat is applied. All nail holes or small openings shall be filled after priming coat is applied and the surface sanded smooth.

4.1.2 Miscellaneous Steel Surfaces. Unsubmerged steel or iron surfaces shall receive an SSPC-SP6 commercial blast.

4.1.3 Piping and Related Items. All exterior surfaces of metallic piping and related items shall receive an SSPC-SP6 surface preparation. Plastic piping shall be solvent cleaned to remove all contaminants.

4.1.4 Piping and Supports. All steel and iron surfaces that operate in submerged or partially submerged conditions shall receive an SSPC-SP10 surface preparation.

4.1.5 Piping Less than 3 Inches. Surfaces shall receive an SSPC-SP3 surface preparation. Galvanized surfaces shall be solvent cleaned per SSPC-SP1 plus any additional preparation required by

paint manufacturer. Copper pipe shall be cleaned of dirt and oxides with appropriate acids or solvents.

4.2 Application. All paints shall be applied in strict accordance with the recommendations of the manufacturer. All surface preparation shall be approved prior to painting. Surfaces shall be painted before any detrimental rusting or soiling occurs after proper surface preparation. Epoxy systems shall be recoated with a second coat within 72 hours of the initial coat application.

4.3 Workmanship. All surfaces shall be thoroughly cleaned and dusted prior to painting. Before painting, remove hardware, lighting fixtures, etc., and replace after painting. Existing conduit and small piping shall be loosened from supports and shifted where possible to permit unobstructed painting. Supports shall be firmly reattached after painting is complete. Fill all holes and sandpaper wood to smooth and even surface and dust off.

The temperature shall be maintained above 60°F where paint is being applied or drying. Do not paint unless protected from dust. Do not paint outside in damp or rainy weather or when temperatures are below 60°F. or at the dew point of the surface to be painted. Allow each coat to dry at least 48 hours. The finished work shall be free of runs, sags, and brushing defects and shall be smooth. Edges shall be cut sharp, clean and without overlap. Touch up and restore damaged finish and leave in good condition. Paint all metal in all areas that are a part of the building whether exposed to view or not.

Handbrush all edges, angles and corners prior to spray application.

The Contractor is solely responsible for all work and shall correct and repair any damage caused by his operations. All paint deposited on surfaces that are not to be painted as part of this contract shall be removed. If removal is not possible, the entire object shall be repainted with the appropriate paint system.

The Contractor shall use extreme care to prevent damage to existing equipment and valves and shall take all possible measures to protect that equipment from fumes, dust, sand, paint, and other related debris.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 11 - EQUIPMENT SECTION 11010 HOISTS

1. GENERAL.

The Contractor shall furnish and install one manually operated trolley hoist on pump rail (S10 x 25.4) directly over pump area and two electric pendant operated trolley hoists, one each on membrane tank hoist rails 1 and 2.

2. APPLICABLE PUBLICATIONS.

Not Used.

3. MATERIALS.

3.1 Pump Manually Operated Trolley Hoist. The pump trolley hoist shall be a geared trolley mounted hand chain hoist with hook suspension and a minimum two ton capacity rating. The hoist shall be a low head room design where the distance from the fully raised hook to the bottom of the trolley beam will not exceed 23 inches. The hoist shall have a lifting distance capability of 22 feet and shall require a maximum chain pull effort of 101 pounds to lift a 2 ton load. The hoist shall be of all aluminum construction and enclosed to provide protection against rough handling. An automatic friction-holding brake shall be balanced for easy lowering of the load. All shafts shall rotate on pre-lubricated ball bearings and require no maintenance. A drop forged heat treated steel hook with latch, electrically welded heat treated load chain, and precision cut heat treated alloy steel gears are required. The hoist shall attach to the trolley with a hook and be easily removable from the trolley. The trolley central shaft shall be pivot mounted to assure smooth travel. Trolley wheels shall have ball bearings for operating ease. Wheels must be maintenance free. Trolley shall be gear operated. The trolley operator chain shall extend down 22 feet below the trolley beam. The trolley hoist shall be Peerless CG hand chain hoist with geared trolley or equal. The trolley shall be compatible with the trolley beam shown on the drawings.

3.2 Membrane Tanks Pendant Trolley Hoists. Each of the two hoists shall be an electric pendant operated geared trolley hoist with hook suspension and a minimum two ton capacity rating. The hoist shall be a low head room design where the distance from the fully raised hook to the bottom of the trolley beam will not exceed 23 inches. The hoist shall have a lifting distance capability of 22 feet. The hoist shall be of all aluminum construction and enclosed

to provide protection against rough handling. All shafts shall rotate on pre-lubricated ball bearings and require no maintenance. A drop forged heat treated steel hook with latch, electrically welded heat treated load chain, and precision cut heat treated alloy steel gears are required. The trolley central shaft shall be pivot mounted to assure smooth travel. Trolley wheels shall have ball bearings for operating ease. Wheels must be maintenance free. Trolley shall be gear operated. The trolley and hoist operator pendant shall be on one unit and extend down 23 feet below the beam. The trolley shall be compatible with the trolley beam shown on the drawings and capable of turning the radius required without any hesitation or difficulty.

4. INSTALLATION.

The hoists shall be installed in accordance with the manufacturer's instructions.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 11 - EQUIPMENT SECTION 11201 PUMPS

1. GENERAL.

1.1 General Requirements. The Contractor shall furnish four submersible turbine pumps installed in the water intake facility well casings at Lower Two Medicine Lake. All electrical equipment for the pumps as well as control equipment will be located in the new intake building being constructed under this contract. Control circuits as well as water transducer cable systems shall be in separate conduits from electrical cable for the submersible pumps. The pump for each application shall be new and of the type specified. Each pump shall meet all the total dynamic head, positive suction head and efficiency requirements specified for that pump. Each pump manufacturer shall certify that his pump shall meet all operating requirements at an elevation of 4,900 feet above sea level. All motors shall have adequate capacity to drive the pump through the full range of the pump impeller curve, continuously without exceeding the listed motor nameplate rating, exclusive of service factor. All motors shall have a 1.15 service factor rating and shall be made in the United States.

1.2 Guarantee. All equipment shall be guaranteed against defects. The Contractor shall file with the Engineer a certified statement that each piece of equipment will function satisfactorily, and that within one year from the date of initial operation, the Contractor shall remove and replace at his expense and without charge to the Owner or his assignee, piece for piece, each piece of equipment, or part thereof, which shall prove defective within the guarantee period. Initial operation shall be defined as the day the equipment is placed into full operation and is being beneficially used by the Owner for its intended purpose on a full time basis.

The Contractor shall also file with the Engineer a certified guarantee from the manufacturer, that the manufacturer guarantees his equipment for a minimum period of one year from the date of delivery. The manufacturer shall guarantee that he will replace at his expense all equipment or parts thereof which shall prove defective within the guarantee period.

All guarantee work shall be done promptly by either the Contractor or the manufacturer upon submittal of proof of defect.

1.3 Installation Personnel. The Contractor shall employ qualified competent personnel for the installation and placing

into initial operation all pumps. He shall include as a part of the pump, the services of a field representative from the firm supplying the equipment to supervise the installation and startup.

All pumps and motor shafts shall be realigned within the manufacturer's specifications after installation and before startup by the representative. The field representative shall remain on the job until the unit is operating satisfactorily.

1.4 Lubricants. The Contractor shall furnish all necessary oils, lubricants, grease guns, or other necessary applicators and shall lubricate the mechanical equipment prior to initial operation. The grade of oil and grease furnished by the Contractor shall be in accordance with the recommendation of the equipment manufacturer. The Contractor shall supply a 12 month supply of each lubricant.

1.5 Manufacturer's Qualifications. The pump and motor manufacturers must have manufactured pumps and motors similar in size and type to those described in this application for a minimum of 40 years. The manufacturers must demonstrate that they do and will continue to supply replacement parts for a minimum of 20 years. The pump manufacturer shall, as a normal operating procedure, maintain records of all pumps and their characteristics that he has sold. The manufacturer shall provide that information without charge to the pump's current owner upon request and presentation of the pump serial number. The pump manufacturer must have a qualified field representative within a 1,500 mile radius of Browning, Montana. This representative shall be skilled in the repair of the vertical turbine pumps supplied and be able to supply parts and repairs within a reasonable time period.

The pump and motor manufacturer shall provide written verification demonstrating that they comply with all requirements of this specification. Pumps and motors shall be made within the United States. Pumps and motors shall have permanently attached legible name plates giving serial numbers and operating characteristics.

1.6 Safety Shields. All electric motors, drives, sprockets, and drive mechanisms shall be provided with safety shields in accordance with OSHA Standards.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 Hydraulic Institute Standards.

2.2 Occupational Safety and Health Administration (OSHA).

2.3 American Society of Testing and Materials (ASTM).

ASTM A-36	Specification for Structural Steel
ASTM A-48	Specification for Gray Iron Castings
ASTM A-53	Specification for Pipe, Steel, Black and Hot Dipped Zinc-Coated Welded and Seamless
ASTM A-108	Specification for Steel Bars, Carbon, Cold Finished, Standard Quality
ASTM A-167	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A-193	Specification for Alloy Steel and Stainless Steel Bolting Material for High Temperature Service
ASTM A-276	Specification for Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A-296	See ASTM A-743
ASTM A-570	Specification for Hot Rolled Carbon Steel Sheet and Strip, Structural Quality
ASTM A-582	Specification for Free-Machining, Stainless and Heat-Resisting Steel Bar, Hot-Rolled or Cold-Finished
ASTM A-743	Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, and Nickel-Base Corrosion-Resistant for General Application
ASTM B-8	Specifications for Concentric-Lay Stranded Copper Conductors, Hard, Medium-Hard or Soft
ASTM B-505	Specification for Copper-Base Alloy Continuous Castings
ASTM B-584	Specification for Copper Alloy Sand Castings for General Application

ASTM F-593 Specification for Stainless Steel Bolts,
Hex Capscrews and Studs

2.4 American Water Works Association (AWWA).

AWWA B-100 Water Wells

AWWA E-101 Vertical Turbine Pumps - Line Shaft and
Submersible Types

2.5 Hydraulic Institute Standard.

2.6 National Electric Code.

2.7 Occupational Safety and Health Administration (OSHA).

Manual 2206 General Industry

2.8 Wire Manufacturer's Standards.

3. MATERIALS.

3.1 General Requirements. Pumps shall be bid based on the following specifications. The pumps shall be designed to meet the following performance requirements when installed in place at Two Medicine Intake site north of East Glacier, Montana at elevation 4,900 feet above sea level. Pumping efficiencies shall meet or exceed the efficiencies listed herein. Three performance points are listed for each pump. The pumps shall meet the performance requirements for head and flow for the primary operating point. The head at shutoff flow may exceed the specified point but may not be less than the head specified. The flow at the secondary point may vary, but the pumps must still be well within the pump curve at the specified head. The pumps must be capable of being operated against a shutoff head at zero flow for short durations without damage to the pump or to the driver. The pumps shall meet all performance points at a rotational speed not to exceed 1770 rpm for the submersible pumps.

The manufacturer shall submit performance curves showing the expected pump head, flow, horsepower, efficiency and net positive suction head requirements over the complete operating range along with complete descriptive material on pump construction and any special setting requirements. The manufacturer shall certify that the pumps will meet the requirements and be within three percent of the specified flow and head value.

3.2 Performance Requirements.

3.2.1 Submersible Pump Nos. 1, 2, 3 and 4.

	Flow (GPM)	Total Dynamic Head (Feet of Water)	Minimum Efficiency %
Shutoff	0	220	0
Primary Point	1250	165	82%
Secondary Point	1600	100	65%

3.3 Submersible Pump.

3.3.1 Submersible Pumps. The submersible pumps shall have the following physical characteristics and be suitable for installation in a 14-inch I.D. well casing and pitless unit:

Maximum Rotating Speed	1,800 rpm
Motor	480 Volt - 3 Phase - 60 hz Vertical, submersible type
Minimum Drop Pipe (Dia.)	8 inches
Bowl Diameter	11.75 inches
Casing Diameter	14 inches

3.3.2 Pump Bowl Assembly. The pump bowl assembly shall be a multi-stage, centrifugal vertical pump with the discharge coaxial with the shaft.

3.3.2.1 Pump Bowls. The pump bowls shall be close grained cast iron conforming to ASTM A-48, Class 30. Bowls shall be enameled or glass lined. Bowls and cases shall have bronze sleeve type bearings to support and guide the shaft. Rubber bearings are not acceptable. The bearing material shall be bronze, conforming to ASTM, B-505, alloy 936. A sand collar of bronze conforming to ASTM B-505, alloy 836 shall be provided to protect the suction adapter bearing from abrasive. The intermediate stages shall be selected to provide the maximum efficiency with the least number of stages. Bowls shall be provided with replaceable bronze wear rings.

3.3.2.2 Pump Impellers. The impellers shall be the fully enclosed type of cast bronze conforming to ASTM B-584, alloy 836. They shall be accurately cast, machined, balanced and filed for optimum performance and minimum vibration. The impellers shall be securely fastened to the bowl shaft with taper collets of stainless steel conforming to ASTM A-582, Grade 416.

3.3.2.3 Bowl Shaft. The bowl shaft shall be of sufficient diameter to transmit the pump horsepower with a safety factor as

required by AWWA E-101 and rigidly support the impellers between the bowl or casing bearings. The shaft shall be high chrome stainless steel conforming to ASTM A-276, Grade 316, 410, or 416.

3.3.3 Suction Adapter. The suction adapter shall be a one piece casting of close grained cast iron conforming to ASTM A-48, Class 30 and designed to serve as the suction inlet, the lower bearing housing and the motor adapter piece. The coupling housing portion shall be designed to prevent the entrance of abrasive material into the top end of the motor. The pump suction shall include a stainless steel strainer. The inlet area shall be equal to at least five times the impeller inlet area. The coupling connecting the motor to the pump bowl assembly shall be of sufficient size and strength to withstand maximum torque generated by the motor plus added safety factor in accordance with AWWA E-101. The coupling shall be of 416 stainless steel and shall be keyed or splined to the pump shaft.

3.3.4 Submersible Motor. The motor shall be 3 phase, 60 cycle, 480 volt, 1800 RPM vertical, submersible type designed for continuous duty underwater operation. The motor shall have a 1.15 service factor. The motor shall not be loaded in excess of its nameplate rating at design primary and secondary points and not be loaded in excess of its nameplate rating at any condition from zero flow to maximum capacity of the pump. The motor shall incorporate a mechanical seal to restrict foreign matter from entering the motor. The thrust bearing shall be of ample capacity to carry the weight of all rotating parts plus the hydraulic thrust and shall be an integral part of the driver.

3.3.5 Submersible Cable.

3.3.5.1 Conductors. The cable shall consist of three separate conductors and a ground cable or a single cable assembly with three conductors and one for a ground. Stranding shall meet ASTM B8, Class B. Each conductor shall be insulated by synthetic rubber or plastic insulation suitable for continuous immersion in water. When three or more single conductors are used, each must be jacketed. When a three or more conductor cable is used, it must be jacketed. The jacket material must be oil and water-resistant synthetic rubber, metal, or other suitable mechanically protective material. The cable shall have a sufficient conductor area to meet the minimum requirement of the IPCEA code for operation in air and be compatible with the total allowable voltage drop from the pump to the remotely mounted starting equipment. The connecting electrical cable from the starting equipment to the pump shall meet the National Electrical Code or local codes, whichever may govern.

3.3.5.2 Supports. The power and low water control cable shall be

suitably supported from the column at ten foot intervals with stainless steel clamps.

3.3.5.3 Fittings. All cable fittings and terminals shall be watertight at the pressure encountered in use.

3.3.5.4 Lengths. For each 50 feet of setting, one foot of extra cable shall be allowed to compensate for possible twist or sag of the cable during installation; 10 feet shall be provided beyond the disconnect near the top of the well.

3.3.5.5 Mechanical Shielding. The electrical conductors shall be protected by a stainless calbe guard shield where they pass the pump bowls.

3.4 Drop Pipe. The drop pipe shall be 8 inch galvanized steel conforming to ASTM A-53 Schedule 40 weighing 28.58 pounds per foot and with ANSI tapered pipe threads. The pipe will be furnished in 10 foot lengths. The pipe will be secured when joined to prevent unscrewing.

3.5 Check Valves. Check valves shall be high strength ductile iron body with threaded female x female connections. The check valve shall have Buna "N" rubber disc, stainless steel spring and fasteners with bronze poppet. The check valve shall be Flomatic Model 80DI or equal.

4. INSTALLATION.

4.1 General. All pumps shall be installed according to the manufacturer's recommendations. A qualified representative of the manufacturer shall supervise and approve the installation and provide all startup services. Pumps direct coupled with motors shall have their shafts realigned and checked after installation is complete and before startup. Shaft alignment shall be within the manufacturer's recommendation and shall meet Hydraulic Institute Standards. Sufficient oils, grease, other lubricants necessary for 12 months operation shall be supplied by the Contractor.

4.2 Submersible Pump. The pump and auxiliary equipment shall be installed in accordance with the manufacturer's recommendations. A 8 inch silent type check valve shall be placed on the drop pipe immediately after the pump and a second 8 inch silent type check valve shall be placed just below the pitless adapter spool.

A conduit and conductors shall be extended from the top of the pitless unit to the motor control unit located in the intake building. Power and control shall be installed in accordance with the electrical section. A pressure transducer for measuring water

depth shall be installed at the location in the intake assembly indicated on the drawings. The control shall extend continuously from the transducer to the level indicator in the intake building.

4.3 Field Test. Following completion of the pump installation and manifold piping, the pump will be tested to determine field performance. The test shall measure flow, head, current on each leg, and voltage. Pumps failing to perform as specified shall be replaced at no additional cost to the Owner.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 15 - MECHANICAL SECTION 15060 PIPE AND PIPE FITTINGS

1. GENERAL.

This section governs the installation of all plant and water intake piping systems above ground including all building and yard pipe which is not described elsewhere. Underground piping beneath buildings is specified in Section 02662 - Underground Piping. The general requirements plant piping shall be as indicated on the drawings. Detailed plans of any proposed departure due to actual field conditions or other causes shall be submitted to the Engineer. All materials shall be new, undamaged, clean, and free of corrosion.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Society of Testing and Materials (ASTM).

ASTM A-36	Specification for Structural Steel
ASTM A-53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
ASTM A-120	Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses
ASTM A-182	Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service
ASTM A-312	Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A-403	Standard Specification for Wrought Austenitic Stainless Steel Piping and Fittings

ASTM B-32	Standard specification for Solder Metal
ASTM B-43	Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B-61	Standard Specification for Steam or Valve Bronze Castings
ASTM B-88 Copper Tube	Standard Specification for Seamless
ASTM D-1784	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (PVC) Compounds
ASTM D-1785	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120
ASTM D-2241	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D-2466	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D-2513	Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings
ASTM D-2564	Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
ASTM D-2665	Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe & Fittings
ASTM D-2729	Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

2.2 American Water Works Association (AWWA).

AWWA C-104	Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water
AWWA C-105	Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids
AWWA C-110	Gray Iron and Ductile Iron Fittings 3 In. through 48 In., for Water and Other Liquids
AWWA C-111	Rubber-Gasket Joints for Gray-Iron and Ductile-Iron Pressure Pipe and Fittings
AWWA C-115	Flanged Gray-Iron and Ductile Iron Pipe with Threaded Flanges
AWWA C-151	Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds for Water or Other Liquids
AWWA C-200	Steel Water Pipe, 6 inches and larger
AWWA C-206	Field Welding of Steel Water Pipe
AWWA C-207	Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.
AWWA C-208	Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C-900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in. for Water

2.3 Federal Specifications (F.S.).

WW-P-501	Steel Fittings, Threaded
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2.4 American Association of State Highway Officials (AASHTO).

AASHTO T-89 Soils	Determining the Liquid Limit of
AASHTO T-90	Determining the Plastic Limit and Plasticity Index of Soils

3. MATERIALS.

3.1 Pipe Materials.

3.1.1 Ductile Iron Pipe. Ductile iron pipe shall conform to the requirements of AWWA Specification C-115 for flanged pipe and AWWA C-151 for non-flanged pipe. All pipe shall be Class 53 minimum and be cement mortar lined in accordance with AWWA C-104. All exterior pipe shall be wrapped in polyethylene AWWA C-105. All interior pipe and pipe exposed to view shall not have a tar coating, but shall be painted in accordance with the specification for pipe painting.

3.1.2 Steel Pipe. Steel pipe shall conform to ASTM A-53, standard wall (Schedule 40) unless otherwise specified. All steel pipe shall be seamless. Pipe conforming to ASTM A-120 is acceptable in applicable size ranges. All steel pipe shall be hot dipped galvanized unless otherwise specified.

3.1.3 Propane Gas Pipe. Propane gas pipe underground shall be polyethylene pipe conforming to ASTM D-2513, SDR 11. Gas piping above ground shall be Schedule 40 black steel pipe conforming to ASTM A-53 or A-120.

3.2 Fittings.

3.2.1 Cast Iron Fittings. Cast iron fittings shall conform to AWWA C-110. All fittings shall be cement lined in accordance with AWWA C-104. The cement lining shall be firmly bonded to the casting and free of cracks or hollow sounding areas when tapped. Fittings shall not be tar coated in exposed areas. Bolts for underground fittings shall be stainless steel. Fitting used inside buildings or exposed to view shall be painted in accordance with the specifications for pipe painting.

3.2.2 Steel Pipe Fittings. Steel pipe fittings shall conform to the requirements of ASTM A-105 and Federal Specification WW-P-501, Class 125.

3.2.3 Polyethylene Gas Pipe Fittings. Polyethylene gas pipe fittings shall conform to ASTM D-2513.

3.3 Joints.

3.3.1 Ductile and Cast Iron Pipe Joints. Ductile and cast iron pipe joints shall be flanged and shall conform to AWWA C-104. Gaskets shall conform to AWWA C-111.

3.3.2 Flexible or Sleeve Couplings. Flexible or sleeve couplings shall have ductile iron bodies and followers and be equal to

Rockwell. Transition or adapter type couplings shall be used as required. Couplings shall have low alloy steel bolts.

3.3.3 Flanged Coupling Adapters. Flanged coupling adapters shall be rated for 150 psi and shall be steel for pipe sizes larger than 12 inches in diameter, and ductile/cast iron for smaller sizes, and be equal to Smith Blair 912 or 913 as appropriate. Couplings shall have low alloy steel bolts and be epoxy coated inside and out. Couplings shall have factor applied anchor bosses with stainless steel studs between bolts. Anchor bosses shall not be utilized on plastic pipe. Sufficient studs shall be provided to restrain pipe movement for working pressures up to 240 psi. The number of studs shall be selected by the manufacturer for the 240 psi pressure. Pipe sizes 8 inches or larger shall have a minimum of 4 anchor studs.

3.3.4 Steel Pipe Joints. Steel pipe joints shall be threaded on pipes 3 inches or smaller and flanged on pipes 4 inches or larger. Steel pipe flanges shall conform to AWWA C-207, Class E.

3.4 Pressure Gauges. Pressure gauges for water shall be of the bourdon tube type and shall be equipped with isolation valves and pulsation dampeners. All gauges shall read in both feet of water and psi and shall have a minimum dial size of 4.5 inches in diameter for water applications and 2.0 inch dials for compressed air system applications and be bottom ported. Gauge scales shall be 0-160 psi as matched to system pressure for the water system. Water gauges shall be Ashcroft Duralife system gauges, or equal.

3.5 Pipe Hangers. Pipe hangers shall be as detailed and called for on the drawings. Materials shall be compatible with the pipe material and not cause corrosion. Saddle type supports shall be cast iron. Fabricated steel saddles are not acceptable except for pipe smaller than 4 inches in diameter.

4. INSTALLATION.

4.1 Application of Materials.

4.1.1 Water Piping. All water piping 4 inches and larger shall be ductile iron flanged pipe above ground push on joints with Fast Grip gaskets underground.

4.1.2 Nipples for Air Release Valves. Nipples shall be galvanized steel pipe.

4.1.3 Iron Pipe Fittings. Iron pipe fittings shall be cast iron or ductile irons. Underground fittings shall be push-on with fast grip gaskets unless otherwise noted. Other fittings shall be flanged as shown on the drawings.

4.1.4 Compressed Air Piping. Air piping shall be steel, Schedule 40.

4.1.5 Gas Piping. Gas piping shall be propane gas pipe. Polyethylene pipe shall be utilized underground, steel pipe shall be utilized above ground.

4.2 Installation.

4.2.1 General. Pipe, valves and fittings shall be installed at locations and to the detail shown on the drawings. The type of pipe shall conform to the classification specified. Underground piping shall be installed as specified in the section on underground piping. All fittings shall be thrust blocked.

4.2.2 Interior Piping. Piping inside or on structures shall be supported on pipe hangers or stands as called for on the drawings, as required under the details and schedules for pipe supports given on the drawings, or as recommended by the manufacturer if closer spacing is recommended whether or not supports are specifically shown on the drawings. Supports shall be placed on all piping within 2 feet of all valves or equipment.

All piping shall be fabricated from field measurements by the Contractor and not from the drawings. Unless called for differently on the drawings, all pipes shall be placed parallel to the floor or wall next to the piping. Piping shall be run so there is no conflict with ducts, light fixtures, etc., so that there is sufficient room for personnel passage and maintenance of equipment. Provisions shall be made for expansion and for contraction. Pipes shall be securely anchored against movement caused by water hammer or other forces.

Pipes cut in the field shall be reamed to the full inside diameter to remove burrs or protrusions. All scale rust or foreign material shall be removed before assembly.

Threaded joints shall have full clean threads. Joints shall be made with an approved oil-graphite compound or Teflon tape applied to the male thread. Use special compounds as required on gas piping. All welded joints shall be done by ASME certified welders holding current certification.

Unions shall be installed on piping less than 4 inches in diameter to facilitate the removal of any piece of equipment without having to cut any pipe. Piping shall be offset and provided with unions or flanges where connected to equipment. Pipes are to be connected to permit the removal of equipment with the minimum amount of disturbance. Di-electric unions shall be used to

connect pipes of different materials for pipes 4 inches and smaller. In order to facilitate installation and removal of equipment with larger pipes, sleeve couplings, flanged coupling adapters and adapter flanges are called for on the drawings. All couplings of this nature shall be provided with restraining rods across the joint to prevent separation of the pipe under pressure.

Pipes passing through tank walls or other walls or floors shall be provided with sleeves. Pipes installed through existing walls and floors shall be installed as detailed on the plans. All holes through existing concrete shall be core drilled to form a smooth hole and the wall passage made watertight with Link Seal. Link Seal shall be utilized to seal the annular space between the pipe and sleeve through all wall passages.

All piping shall be thoroughly flushed and cleaned prior to testing. All pipe shall be pressure tested.

4.3 Pressure Testing.

4.3.1 Pressure Testing Piping. Pressure testing of interior piping shall be in combination with underground piping under the requirements of Section 02662 - Underground Piping.

A leakage test on all underground piping shall be conducted concurrent to the pressure test as specified in the section on underground piping.

4.3.2 Pressure Testing Air Piping. Air piping shall be tested with air and at a pressure of 200 psi. The system shall hold a constant pressure without a drop for four hours. All joints shall be soaped and observed for leakage during the test. The pipe shall be repaired and retested if leakage is observed at the joints or if the pressure decreases during the test period.

4.4 Clean Off Exposed Piping. The Contractor shall clean all exposed piping, valves and fittings to be free of grout, caulking, tar and other contaminants.

4.5 Disinfection. All plant domestic use water supply piping and all potable water piping including the high service intake header shall be disinfected in the same manner as described in the section for underground piping.

4.6 Pipe Protection. The Contractor shall provide protection for all pipe which may be subject to damage during later construction and shall replace any piping which is damaged.

4.7 Existing Piping. The Contractor shall remove all piping noted on the drawings.

4.8 Pipe Painting. All piping, fittings, valves and pipe supports shall be painted. Painting shall be in accordance with the requirements of the Section, Painting.

END OF SECTION

CONSTRUCTION SPECIFICATIONS
DIVISION 15 - MECHANICAL
SECTION 15061
WATER PLANT AND INTAKE VALVES

1. GENERAL.

This section governs the installation of all above ground valves. The general requirements, locations and type of a valve shall be as indicated on the drawings and described herein. All valves shall be new and undamaged. All valves related to the automatic operation and control of the filters shall be supplied by the manufacturer of the prefabricated treatment units.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Water Works Association (AWWA).

AWWA C-500	Resilient Seated Gate Valves, 3 In. through 48 In. and Sewage Systems
AWWA C-504	Rubber Seated Butterfly Valves
AWWA C-508	Swing-Check Valves for Waterworks Service, 2 In. through 24 In. NPS

2.2 Federal Specifications (F.S.).

WW-V-54D	Gate Valves, Bronze, Threaded Ends
WW-V-51F Valves, Bronze	Check Valve, Angle and Globe

3. Materials.

3.1 Gate Valves. Gate valves shall be resilient seat flanged gate valves conforming to the requirements of AWWA Specification C-509 for valves 3 inch and larger and Federal Specification WW-V-54D for 3 inch and smaller. Flanged valves shall have 150 lb. flange drilling and be rated for a 150 lb working pressure. Resilient seat valves shall have epoxy coated interiors on all ferrous metal surfaces and shall be equipped with handwheels and

gear operators with non-rising stems. Valves small than 4 inches shall have threaded ends and shall be bronze with threaded ends.

3.2 Ball Valves for Water and Air Applications: Two inch and smaller ball valves for waterlines shall be of stainless steel, bronze or brass construction with bronze, brass, or stainless steel ball teflon or viton stem seal, reinforced teflon seats and thrust washer, a removable operating lever, and threaded ends. Valves shall be pressure rated to a minimum 250 psi and shall be driptight in both directions and shall be Watts B-5900 Series, Jamesbury "Series 1000, Fig. 11-1100TT", Lunkenheimer "Fig. 70-XLT", Stockham "S-216", or Power "Fig. 4210 B" or equal. Extended handles or tee handles shall be supplied where necessary to clear other obstructions.

3.3 Pressure Relief Valve. Pressure relief valves shall be hydraulically operated, diaphragm actuated valves either in a globe pattern or angle pattern as indicated on the drawings. Valves shall be flanged ANSI 16.1 (125 pound drilling) on sizes 4-inch and larger. The diaphragm assembly shall be guided top and bottom by a precision machined stem and the valve seats shall be replaceable. A resilient synthetic rubber disc, retained on three and one half sides by a disc retainer, shall form a drip-tight seal when pressure is applied above the diaphragm. Valve body and cover shall be cast or ductile iron and rated for 150 psi working pressure. Disc guide seat and cover bearing shall be bronze. The stem, nut, and spring shall be stainless steel. The pressure reducing control shall be bronze with stainless steel trim and valve cocks on sensing lines shall be provided with the control valve. Valves shall be adjustable from 30 to 150 psi. Initial setting shall be 95 psi.

3.4 Pressure Gauges. Pressure gauges shall be of the Bourdon tube type with stainless steel bodies and a minimum 4-inch diameter face. The gauge shall be scaled in feet of water and psi over a range from 0 to 150 psi. Gauges shall be provided with snubbers to dampen pressure fluctuations.

4. INSTALLATION.

4.1 Application of Materials.

4.1.1 Water Valves. Water valves less than 4 inches in diameter utilized for isolation of piping or equipment shall be ball valves. tee handles or extended handles shall be utilized where conflicts or space limitations interfere with lever handles. Valves 4 inches or larger shall be gate valves with handwheel operators.

4.1.2 Air Valves. All valves on air supply lines utilized for

isolation of piping or equipment shall be ball valves. Tee handles or extended handles shall be utilized where conflicts or space limitations interfere with lever handles.

4.2 Installation. Unions shall be installed in all piping within 6 inches of all valves with threaded ends in order to permit easy removal of the valve. Tee handles or extended handles shall be utilized on ball valves where other items conflict with valve operation.

Valves for horizontal pipe runs shall be installed with operating stems in the vertical position for lines within four feet of the floor, 45° or 30° off vertical if pipes above the valve interfere with operation and maintenance of the vertical installation, and horizontal for pipes over four feet from the floor. Valves on vertical pipe runs shall be installed with operating stems perpendicular to the wall. Handwheels, gear operators, pneumatic operators and electric operators shall be sized by the manufacturer for the valve size and system pressure. Pneumatic and electric actuators shall be installed only in positions recommended or approved by the manufacturer.

A pressure gauge shall be installed in the piping manifold upstream of each pressure reducing valve.

END OF SECTION

CONSTRUCTION SPECIFICATIONS
DIVISION 15 - MECHANICAL
SECTION 15061
WATER PLANT AND INTAKE VALVES

1. GENERAL.

This section governs the installation of all above ground valves. The general requirements, locations and type of a valve shall be as indicated on the drawings and described herein. All valves shall be new and undamaged. All valves related to the automatic operation and control of the filters shall be supplied by the manufacturer of the prefabricated treatment units.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Water Works Association (AWWA).

AWWA C-500	Resilient Seated Gate Valves, 3 In. through 48 In. and Sewage Systems
AWWA C-504	Rubber Seated Butterfly Valves
AWWA C-508	Swing-Check Valves for Waterworks Service, 2 In. through 24 In. NPS

2.2 Federal Specifications (F.S.).

WW-V-54D	Gate Valves, Bronze, Threaded Ends
WW-V-51F Valves, Bronze	Check Valve, Angle and Globe

3. Materials.

3.1 Gate Valves. Gate valves shall be resilient seat flanged gate valves conforming to the requirements of AWWA Specification C-509 for valves 3 inch and larger and Federal Specification WW-V-54D for 3 inch and smaller. Flanged valves shall have 150 lb. flange drilling and be rated for a 150 lb working pressure. Resilient seat valves shall have epoxy coated interiors on all ferrous metal surfaces and shall be equipped with handwheels and

gear operators with non-rising stems. Valves small than 4 inches shall have threaded ends and shall be bronze with threaded ends.

3.2 Ball Valves for Water and Air Applications: Two inch and smaller ball valves for waterlines shall be of stainless steel, bronze or brass construction with bronze, brass, or stainless steel ball teflon or viton stem seal, reinforced teflon seats and thrust washer, a removable operating lever, and threaded ends. Valves shall be pressure rated to a minimum 250 psi and shall be driptight in both directions and shall be Watts B-5900 Series, Jamesbury "Series 1000, Fig. 11-1100TT", Lunkenheimer "Fig. 70-XLT", Stockham "S-216", or Power "Fig. 4210 B" or equal. Extended handles or tee handles shall be supplied where necessary to clear other obstructions.

3.3 Pressure Relief Valve. Pressure relief valves shall be hydraulically operated, diaphragm actuated valves either in a globe pattern or angle pattern as indicated on the drawings. Valves shall be flanged ANSI 16.1 (125 pound drilling) on sizes 4-inch and larger. The diaphragm assembly shall be guided top and bottom by a precision machined stem and the valve seats shall be replaceable. A resilient synthetic rubber disc, retained on three and one half sides by a disc retainer, shall form a drip-tight seal when pressure is applied above the diaphragm. Valve body and cover shall be cast or ductile iron and rated for 150 psi working pressure. Disc guide seat and cover bearing shall be bronze. The stem, nut, and spring shall be stainless steel. The pressure reducing control shall be bronze with stainless steel trim and valve cocks on sensing lines shall be provided with the control valve. Valves shall be adjustable from 30 to 150 psi. Initial setting shall be 95 psi.

3.4 Pressure Gauges. Pressure gauges shall be of the Bourdon tube type with stainless steel bodies and a minimum 4-inch diameter face. The gauge shall be scaled in feet of water and psi over a range from 0 to 150 psi. Gauges shall be provided with snubbers to dampen pressure fluctuations.

4. INSTALLATION.

4.1 Application of Materials.

4.1.1 Water Valves. Water valves less than 4 inches in diameter utilized for isolation of piping or equipment shall be ball valves. tee handles or extended handles shall be utilized where conflicts or space limitations interfere with lever handles. Valves 4 inches or larger shall be gate valves with handwheel operators.

4.1.2 Air Valves. All valves on air supply lines utilized for

isolation of piping or equipment shall be ball valves. Tee handles or extended handles shall be utilized where conflicts or space limitations interfere with lever handles.

4.2 Installation. Unions shall be installed in all piping within 6 inches of all valves with threaded ends in order to permit easy removal of the valve. Tee handles or extended handles shall be utilized on ball valves where other items conflict with valve operation.

Valves for horizontal pipe runs shall be installed with operating stems in the vertical position for lines within four feet of the floor, 45° or 30° off vertical if pipes above the valve interfere with operation and maintenance of the vertical installation, and horizontal for pipes over four feet from the floor. Valves on vertical pipe runs shall be installed with operating stems perpendicular to the wall. Handwheels, gear operators, pneumatic operators and electric operators shall be sized by the manufacturer for the valve size and system pressure. Pneumatic and electric actuators shall be installed only in positions recommended or approved by the manufacturer.

A pressure gauge shall be installed in the piping manifold upstream of each pressure reducing valve.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 16 - ELECTRICAL SECTION 16890 INTAKE PUMP CONTROL SYSTEM

1. GENERAL.

1.1 General Requirements. The Contractor shall provide a pressure/level transducer and level display/controller for the intake pumps. System components and operation shall be as described in this specification. Control alternation, logic functions, alarm and all other control components used in the control system shall be performed by solid-state components unless otherwise specified. All components shall be standard catalog items with proven field performance. Replacement components or modules of each type shall be stocked by the system manufacturer for system expansion or parts replacement. Non-standard, "one of a kind", experimental, or unproven combinations of equipment will not be allowed. The manufacturer shall show evidence that parts are kept in inventory and are readily available within 14 days of receiving an order.

The Contractor shall provide all material, equipment, labor, and miscellaneous items necessary to make the control systems complete and fully operational. All signals between transmitters, receivers, and other control devices shall be protected against interference of all types. All equipment shall be installed with power surge and lightning protection.

All equipment shall be supplied by a single manufacturer's representative who is skilled and experienced controls. This representative shall be responsible for properly integrating the various pieces of equipment into a fully functional and operational control system.

All system components shall be new, high quality, and factory mounted and inspected. All electrical control components shall operate on 120 volt, 60 Hz, single phase power except as otherwise noted on the drawings and specifications. All work shall be in accordance with the requirements of the drawings and specifications. The various requirements of Division 16 - Electrical, apply to the construction of the control system.

1.2 Description of Operation. The primary start/stop control for each of the four pumps will be from the water treatment plant. The water treatment plant control system is not part of this contract but will be installed at a later date with a four pair communication wire connecting each of the intake pumps to the

plant control. The equipment supplied under this contract shall be compatible with future connection of control wiring from the water treatment plant. The pressure transducer and level display controller shall function such that if the water level in the intake drops below an adjustable preset level, then all of the intake pumps will be shut down. Start up of intake pumps following an automatic shut down will require manual reset.

1.3 Codes, Regulations, and Permits. All materials, components, and equipment shall be approved by Underwriters' Laboratories, Inc. where applicable and by the local inspection authority. All materials shall be in a new and undamaged condition when installed.

The Contractor shall comply with the National Electrical Code, National Electrical Safety Code, State of Montana Electrical Code, Uniform Building Code and all other applicable Federal, State, City, and County Codes, regulations, and ordinances. The Contractor shall obtain and arrange for all permits and approvals required for the execution of the work and pay all fees required to obtain such permits and approvals.

1.4 Drawings and Manuals. The manufacturer shall supply equipment information, shop drawings and operation and maintenance manual data as required in Division 1, Section 01300 and 01301. Information shall include:

1. Dimension drawings, wiring and/or piping drawings for equipment.
2. Fabrication and nameplate legend drawings and internal wiring schematic drawings.
3. System schematic drawings illustrating all components being supplied, complete with electrical interconnections, color codings and labeling of electrical wiring and all control devices. All wire and terminal strip numbers shall be clearly labeled at all termination points on each piece of assembled equipment and shall match identification on the control drawings.
4. Any other information that will assist the Engineer with understanding the equipment operation and will assist the Engineer with approval.

All field mounted components shall be clearly labeled and identified. Identification shall be the same as shown on the control drawings.

1.5 Field Calibration. All instrumentation shall be calibrated in the presence of the Engineer in accordance with the range and accuracy specified herein.

1.6 Guarantee. All equipment shall be guaranteed against defects. The Contractor shall file with the Engineer a certified statement that each piece of equipment will function satisfactorily, and that within one year from the date of initial operation, the Contractor shall remove and replace at his expense and without charge to the Owner or his assignee, piece for piece, each piece of equipment, or part thereof, which shall prove defective within the guarantee period. Initial operation shall be defined as the day the equipment is placed into full operation and is being beneficially used by the Owner for its intended purpose on a full time basis.

The Contractor shall also file with the Engineer a certified guarantee from the manufacturer, that the manufacturer guarantees his equipment for a minimum period of one year from the date of initial operation. The manufacturer shall guarantee that he will replace at his expense all equipment or parts thereof which shall prove defective within the guarantee period. All guarantee work shall be done promptly by either the Contractor or manufacturer upon submittal of proof of defect.

1.7 Installation Personnel. The Contractor shall employ qualified competent personnel for the installation and placing into initial operation all control components. He shall include as a part of the control system, the services of a field representative from the firm supplying the equipment to supervise the installation and start up. The field representative shall remain on the job during start up until all units are operating satisfactorily and shall provide a minimum of 24 hours of instruction and training for the Owner's personnel on proper operation, maintenance and adjustment of equipment.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by basic designation only. References are to the later edition of each publication.

2.1 Codes.

Underwriters' Laboratories, Inc. (U.L.)
National Electrical Code (NEC)
National Electrical Safety Code
State of Montana Electrical Code
Uniform Building Code (UBC)

3. MATERIALS.

3.1 Pressure Transducer/Level Sensor. A submersible pressure transducer shall sense water level in the header at the intake site. The transducer shall be a Model 6000 unit as manufactured by Sigma Controls, Inc. or approved equal. The unit shall be scaled from 0 to 40 feet of water. The transducer shall have a 316 stainless steel body with a Teflon coated polyimide diaphragm and internal solid state electronic gauge pressure transducers. The sensor shall incorporate an isolated solid state piezo-resistive pressure transducer which provides excellent linearity, repeatability and low hysteresis. The transducer shall have an input voltage compatible with the voltage available at the site or include a suitable transformer to power the transducer. The transducer shall include a 4 - 20 mA output that is connected to a level display unit.

The level display control shall supply the required input DC control for the transducer. It shall also convert the 4 - 20 mA signal from the transducer to a calibrated water level. The level display control shall be supplied from the same manufacturer as the transducer. Calibration shall be capable through a single front panel push button. A separate power supply shall be provided if needed. The display shall include a ½-inch red LED. The unit shall have over pressure protection and be designed to withstand pressures two times the full scale. The transducer shall be capable of transmitting the signal the required distance to the intake building. A Nema 4 enclosure shall be provided. A suitable number of output signals shall be provided from the control to each of the pumps. Adjustable current relays shall be provided to open the pump control circuits and stop the pumps.

4. CONSTRUCTION

4.1 General. The Contractor shall construct a complete and operable control system that provides all control features as described in the contract documents and required for operation. The Contractor shall provide all necessary interconnections between equipment items regardless of whether or not they are specifically shown or called out on the drawings. All equipment shall be installed in strict accordance with the manufacturer's instructions and all applicable electrical codes. The completed system shall include all control features and functions as described under Description of Operation.

4.2 Incoming Power and Wiring. Incoming power for control circuits shall be 120 volt, single phase, 60 Hz. All wiring within cabinets shall be flexible, standard type and each conductor shall be tagged and numbered in accordance with the

manufacturer's wiring diagrams. All outgoing wires shall be fastened to electrical components by solder-less mechanical connectors to facilitate replacement. All wiring shall be neatly tied and fastened to the chassis as required.

Conduits and conductors shall be installed as necessary between the control centers and all remotely mounted control devices. These conduits and conductors are not necessarily shown on the contract drawings but shall be the responsibility of the Contractor to provide and install in order to provide a complete and operational system.

END OF SECTION